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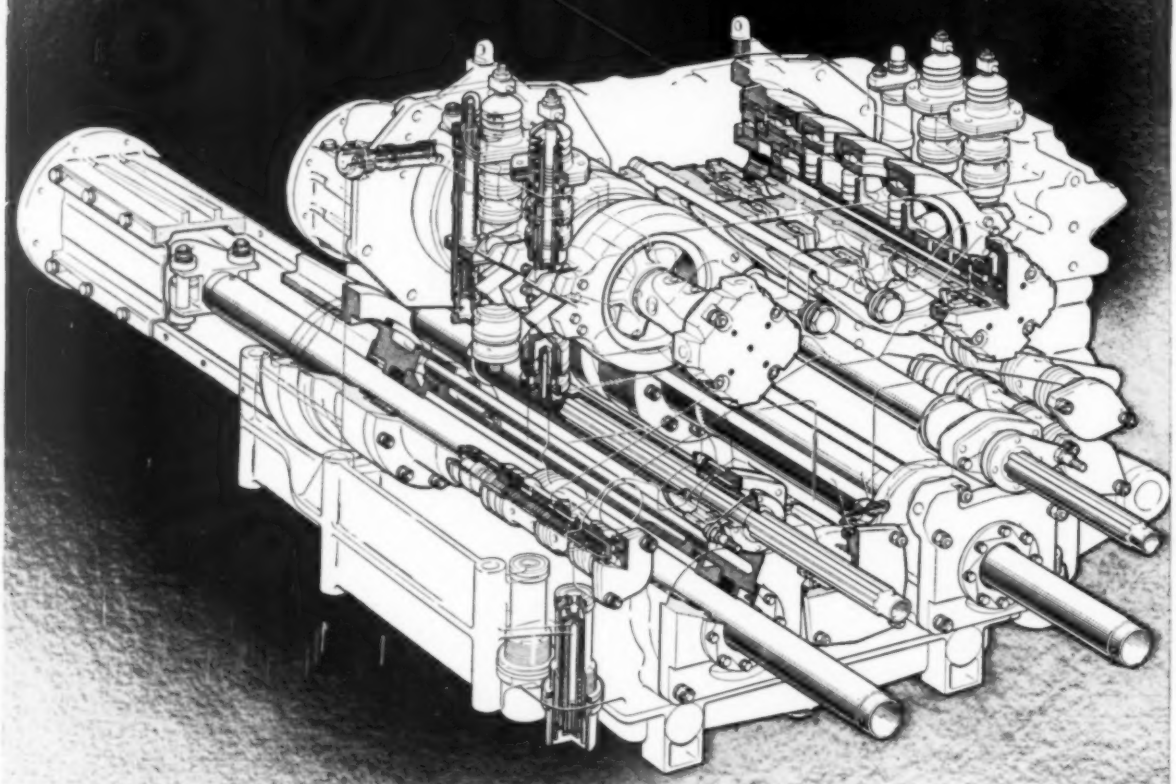

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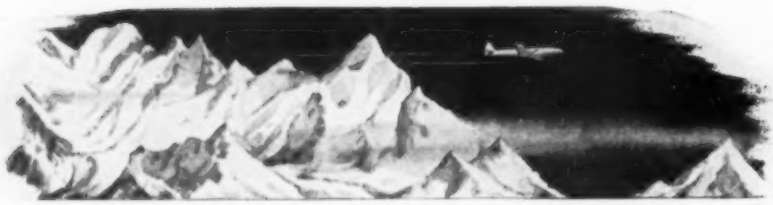

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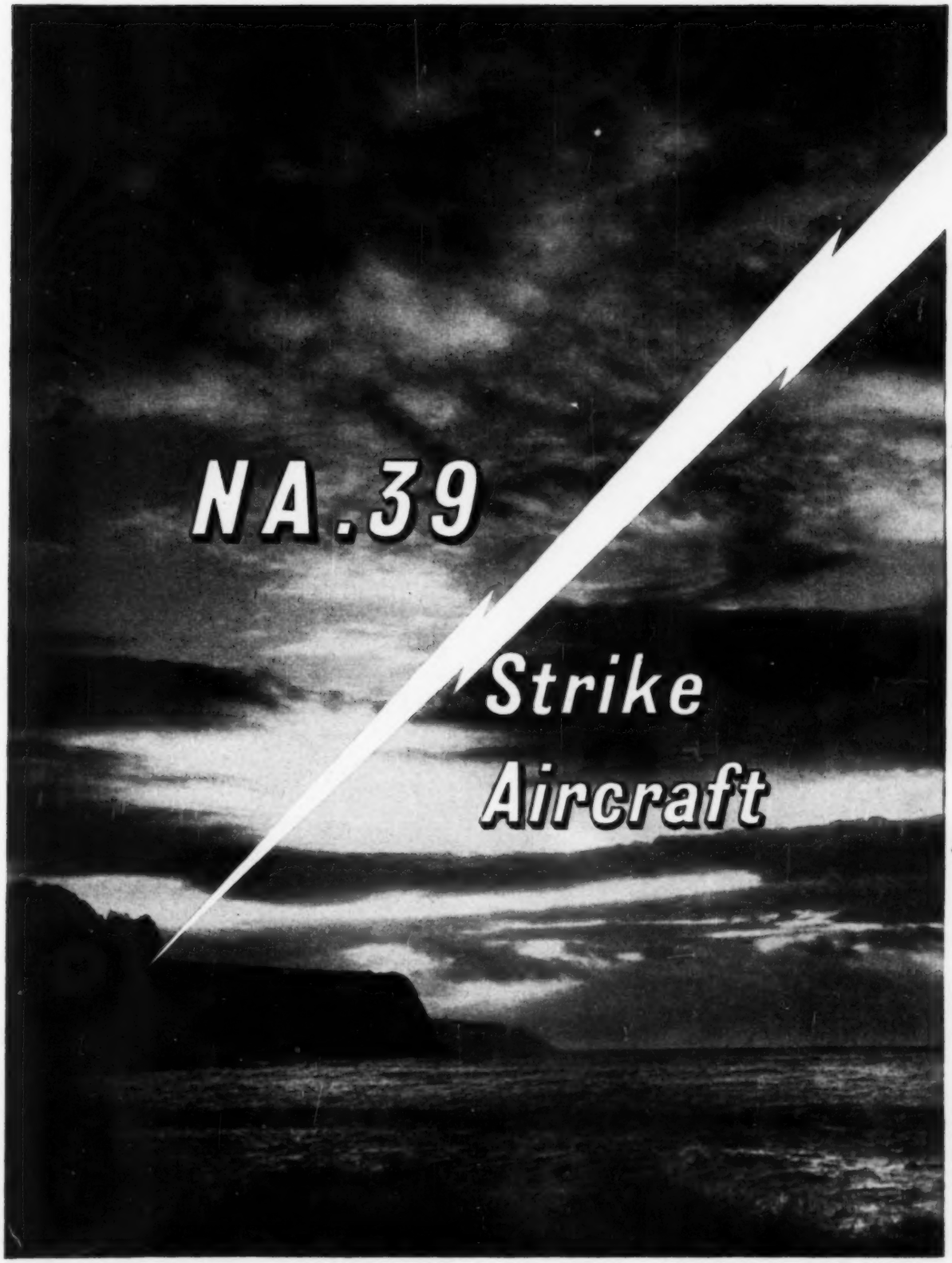

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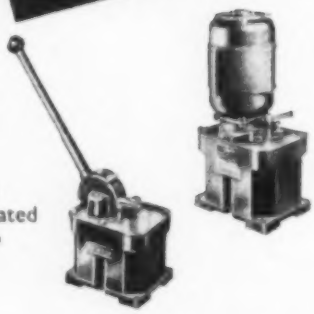

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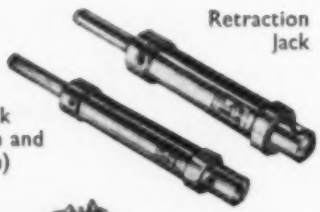

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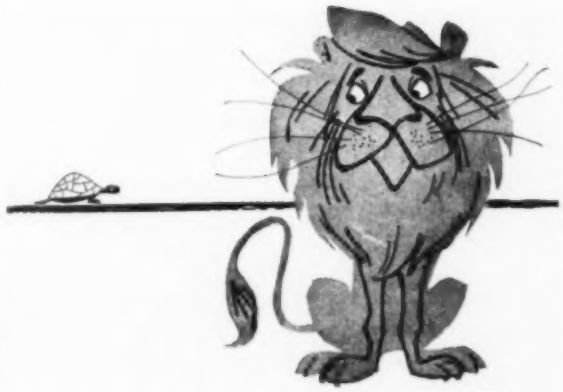

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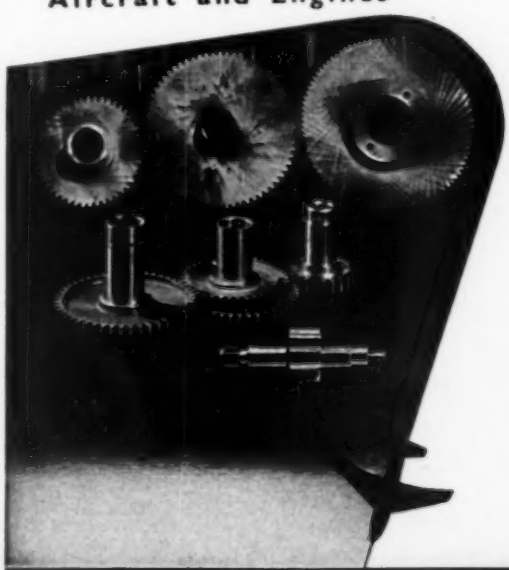

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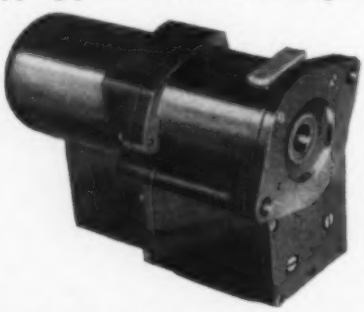

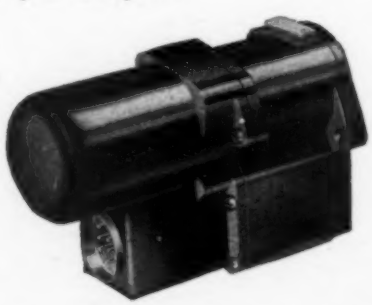

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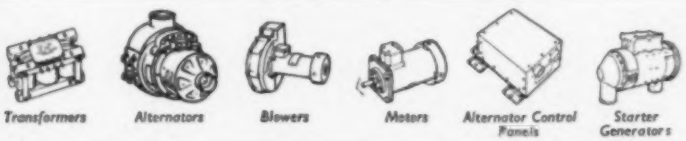

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and
AIRCRAFT ENGINEER

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Editor
MAURICE A. SMITH D.F.C. AND BAR

Associate Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

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Thoughts in the Fog—

PROCEEDING on their lawful occasions from London Airport (as they hoped) representatives of this journal found themselves last week confined and confounded by fog. And any reader who has not himself been stricken by this calamity may be assured that the world of travel offers few experiences to compare with it for utter, cumulative misery.

The same thought was crossing our mind as we contemplated the fog-enchanted beauty of our Viscount 800 through the lounge window—enchantment that might have been marred in the eyes of B.E.A.'s chairman by the figure "£40,000" blazed in red on the murk—representing one day's fog-loss to his Corporation.

It happened at that moment that we were joined by a Member of Parliament and by the managing director of a company which makes a world-reputed navigational aid. "Why," demanded the M.P. (who has a reputation for edifying comment and searching inquiry in air matters), "why, with such efficient aids available, should we be stuck here like this?"

"The answer, of course," the M.D. assured him, "is that there is no technical necessity whatever. It is perfectly possible to operate even in the densest fog. But," he added, "it is not perfectly *safe*."

Which brought us then, and brings us now, to meditate.

—and Deeds in the Fog

Recorded cases of completely blind take-offs and landings are many. Something over a quarter of a century ago such men as Pat Johnson and Jimmy Doolittle, respectively British and American, made complete flights under a canvas hood with no more elaborate aid than the blind-flying instruments of those days. Before World War 2 the German Lorenz system, and since then S.B.A. and I.L.S., have been used for the purpose of achieving blind landings in "zero zero" visibility. Take-offs from runways using flight instruments alone are standard procedure for qualified airline and Service pilots. In many other cases, pilots have been successfully talked down to a blind landing with the aid of G.C.A.

Although blind landings have been frequent, the techniques have never been considered sufficiently certain and safe, taking all factors into consideration, for the airlines to adopt them as standard procedure. They require high ability and constant practice and must rely to some extent on human factors which are not 100 per cent predictable. The alternative to giving the pilot a means of landing without seeing the ground is to provide the airfield with a means of locally clearing the air. Fido is the pre-eminent example of such a device, but it is extremely costly and has never been widely adopted.

During recent years director-type instruments have been developed to interpret I.L.S. indications into direct and simple commands to the pilot. The next step was to feed these commands straight into the autopilot; many civil and military aircraft carry autopilots with approach couplers and can descend along the glide path virtually under automatic control down to heights officially limited at approximately 200ft. The transition from the final approach to the ground run is, after all, the most critical and precise phase of any flight, whether under human or automatic control; and an I.L.S. approach coupler combination has limitations at this point. One of several promising ways of achieving the transition is to follow the electrical signals emitted from leader cables buried on the runway centreline, and match them with the signals from a radar altimeter to produce a co-ordinated touch-down control for the autopilot. This is in fact being done with Canberras by the Blind Landing Experimental Unit at R.A.E., Bedford.

Work to bridge the gap between the approach and the ground run is continuing but, in the meantime, a number of problems must be solved. The equipment must be completely reliable or duplicated before the airlines will make routine use of it. It might be heavy and it will be expensive; and the airlines will have to balance its total cost against the losses they now suffer in fog.

FROM ALL QUARTERS

Making History

SINCE the first meeting of the Brabazon Committee in 1943 this country has been planning for the day when a British aircraft, flown by a British airline, would operate non-stop passenger services between London and New York. This event is due to take place next Thursday, December 19, when B.O.A.C. Bristol Britannia 312 is to inaugurate a 52-passenger *de luxe* service, at a once-weekly frequency to start with. Timetable of the westbound service, which will be in daylight, is published on page 913; the eastbound service, which will be overnight, leaves New York at 1800 hr, reaching London (9 hr 50 min later) at 0850 G.M.T.

B.O.A.C. plan to extend Britannia 312 operations to other points in America and Canada in the spring. The aircraft "will be operated in *de luxe*, first-class and tourist versions, according to route requirements." Later in 1958 the Britannia is due to take over "Monarch" services from the Stratocruiser.

After the first Britannia service on Thursday the service will depart from London every Friday, returning from New York on Sundays.

Footnote: Last Saturday, one of El Al's three Britannia 313s made the fastest-ever commercial airliner crossing from New York to London—in 8hr 3min. The Israeli airline is due to inaugurate regular Britannia services between Tel Aviv and New York (with traffic rights at London) four days after B.O.A.C., on December 23.

Vanguard Failure

ON December 6 America's first attempt to launch an artificial satellite ended disastrously, as a result of mechanical failure. This was the first time that a complete Vanguard three-stage vehicle had been readied for firing at Patrick A.F.B., and the occasion was preceded by widespread comment and publicity.

After a twice-interrupted count-down, begun at 1 a.m., the vehicle was finally fired at 11.45 a.m. local time. When the Vanguard was barely off the pad the chamber pressure in the first-stage motor (a 27,000-lb-thrust gimballed chamber by G.E., described in our "Aero Engines" issue of July 26 last) became drastically reduced, and the resulting loss of thrust caused the vehicle to fall back on to its pad. Structural failure followed, and explosion of the remaining propellants. The fireball reached a diameter of some 100ft and destroyed the first and second stages, but the satellite was picked out of the third stage still functioning.

Extraordinary and wholly unwarranted reactions followed this failure, including heavy selling of missile shares on the New York stock exchange. For an hour and a half trading in shares of The Martin Company (prime contractor for Vanguard) had to be suspended. The circumstances of the failure parallel those of the first SM-75 Thor ballistic missile; in this case loss of chamber pressure was caused by malfunction of a valve in the liquid-oxygen supply.

Decca Mk 10 Demonstrated

ALTHOUGH dense fog prevented an in-flight demonstration, the Decca Navigator Company was last week able to show at London Airport one of the first Decca Mk 10 receivers installed in a Viscount 800 of B.E.A. For the occasion a second receiver and Flight Log were mounted in the passenger cabin. All B.E.A. Viscount 810s will carry the Mk 10 as standard next year.

As explained by Decca engineers, the great advance offered by the Mk 10 over the traditional Mks 7 and 8 is its semi-automatic operation. Up to now each of the three Decometers has had to be set up individually and the Flight Log synchronized with them. Now, all notching, referencing and lane identification processes are automatic; and synchronization of the log is partly so. The chart remains still while the pen is placed on a referencing point and difficult manipulation of the slewing switches is largely avoided. Charts are arranged so that the pen can often move directly on to a new projection pattern without being lifted, and only a scale-selector switch has to be reset. After loss of signal the Flight Log will reset itself; and it will fail safe in case of malfunction. The semi-automatic zone identification system has an ambiguity distance of five zones so that, on the edge of cover, the position of the aircraft need only be known to the nearest 100 miles or so. The panels and dials have been considerably simplified.

AIR MINISTRY PROMOTIONS: Mr. H. T. Smith (left) and Mr. R. H. Melville, whose appointments as Deputy Under-Secretaries of State at Air Ministry in succession to Sir Victor Raby and Sir Folliott Sandford have recently been announced. (See Service Aviation, p. 938.)

Scottish Aviation Tragedy

WE learn with great regret, as we go to press, that Mr. D. F. McIntyre, managing director of Scottish Aviation, Ltd., lost his life when the Twin Pioneer G-AOEO in which he was flying crashed in Tripolitania last Sunday. Capt. Roy Smith, senior test pilot, Mr. R. C. Clapham, an engineer officer and three passengers, whose names are not so far known, were also killed. The aircraft was on a demonstration flight.

Mr. McIntyre, a former C.O. of No. 602 (City of Glasgow) Sqn., R.Aux.A.F., later attaining the rank of group captain, was one of the pilots on the Houston Mount Everest Flight Expedition in 1933. With the Duke of Hamilton, now chairman of Scottish Aviation (and, as Lord Clydesdale, chief pilot on the Everest Flight Expedition), Mr. McIntyre was co-founder of both the company and of Prestwick Airport. He was also managing director of Scottish Airlines, Ltd.

Mr. D. F. McIntyre.

Capt. Roy Smith.

The McKenna Dinner

THE completion of No. 16 Course at the Empire Test Pilots' School was marked by the annual McKenna dinner held in the E.T.P.S. mess at Farnborough on Thursday of last week. This year 28 pilots completed the course and four of them obtained distinguished passes. The McKenna Trophy, for the most outstanding performance, was presented by Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft)

THE DEEP SOUTH: A Lockheed P2V Neptune of the U.S. Navy prepares for take-off for the first flight of the year to the South Pole. The Neptune is based at McMurdo Sound, and is used for scientific studies in conjunction with the International Geophysical Year.

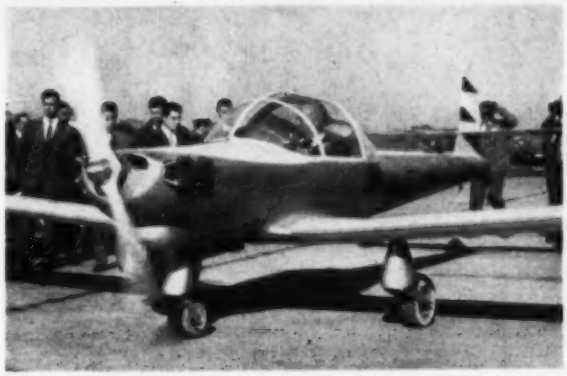
ELECTRA: Last Friday, 56 days ahead of the schedule set more than a year ago, the first Lockheed Electra (seen here on the day of its roll-out) made an 87-min maiden flight at Burbank. Test pilot "Fish" Salmon described the 1,800ft take-off as "phenomenal."

Ltd., to Lt-Cdr. T. C. Evans, R.N., who now goes to join the Naval Squadron at Boscombe Down.

Strangely, the Commandant, G/C. R. E. Burns, did not call for the traditional "schoolmaster's titfer" before welcoming the guests (or those of them who had not been prevented from attending by the fog which still blanketed parts of the country). He stated that the optimum strength of a course had been found to be 35, but that economies following the Suez operations last year had made it necessary to refuse the applications of six foreign pilots. No. 16 Course nevertheless included representatives from India and Holland, as well as from the Commonwealth and the United States. Commenting on impending economy cuts, G/C. Burns said that test pilots would continue to be required and that a school was the best institution for training them. He therefore suggested that all test pilot-training establishments in the Commonwealth, the industry and NATO be combined into a single unit. Further development of the V-bombers was suggested as one of the many tasks test pilots would have to carry out in the future.

Sir George Edwards said that tears already in his eyes prevented him from reading the tear-jerking speech he had prepared on the troubles of the industry. The procurement *versus* design curve was now, he continued, in a trough and the industry would in two-and-a-half years be breaking its neck to build aircraft which had not been ordered five years before. A proportion of the funds allocated to aircraft procurement was dissipated by other agencies before they reached the companies who had to spend them on design and construction. It was in any case certain and clear that the industry was "going to be broke."

In very much more serious vein, Sir George paid tribute to the work of test pilots who were, he said, the only men in the whole design and production chain who really risked their lives to prove the products. It was the test pilot who could make a poor start into something worthwhile; and it was fatal either to employ bad test pilots or to take no notice of what the good ones said. He adjured all those present to speak their minds and to take any recommendations about aircraft they were testing straight to the man who was really responsible for the project.



AEROSCOOTER: Designed by, and flown by, the famous airman Mario de Bernardi, this little Italian two-seater is claimed to land in 130ft.

MR. GODFREY AUTY has been appointed deputy chief test pilot to Bristol Aircraft, Ltd. He joined the flight test staff in 1951, after test flying at R.A.F. maintenance units. Born in 1921, he joined the R.A.F. in 1940. He saw service with No. 21 Sqn., 2nd T.A.F., and with No. 62 Sqn., S.E. Asia Command; he also flew Mosquitoes, Dakotas and other types as a ferry pilot. Mr. Auty has been responsible for much of the flight development work on Britannias and on Bristol turbojet engines. He is at present in Mexico, supervising Britannia training with Aeronaves de Mexico S.A.

STRATOLINER: Due to be the first of the new American transports to fly, the Boeing 707-120—also seen here on the day of its roll-out—has been beaten to the post by the Electra. It is still on schedule, however, being due to fly just after Christmas.

ORPHEUS-POWERED: The new Japanese T1F2 trainer, powered by a Bristol Orpheus turbojet and built by Fuji Heavy Industries, Ltd. Three examples have been completed and seven more will be built before large-scale production begins. An engine of indigenous design is intended for later machines.

THE LAST BLENHEIM in service—with the Finnish Air Force—is seen here in company with the Edgar Percival E.P.9 demonstrator G-AOZO which, when the photograph was taken, was on its way to be demonstrated to the Finnish Chief of Staff. The Blenheim is in regular service for mapping and forestry patrol.

FROM ALL QUARTERS . . .

Hunting Percival Name-change

BY a decision announced last week, the name "Percival" now disappears from the title of Hunting Percival Aircraft, Ltd. Henceforth the company will be styled Hunting Aircraft, Ltd., thus completing the process of identification with the Hunting Group, of which it has been a member since 1944.

Older readers will recall that the original Percival company was responsible for the Gull and Proctor series of light aircraft. Since the Hunting Goup acquired the company towards the end of the war the reorganized and modernized Luton factory has designed and produced a number of types including all three of the Royal Air Force post-war basic trainers—Prentice, Provost and Jet Provost.

Another type, the twin-engined Pembroke light transport and general purpose aircraft, is in service with seven air forces, including the R.A.F. and the newly reconstituted West German Air Force. The President, civil version of the Pembroke, is available to commercial operators for charter, executive and survey work.

Canadian Jet Trainer

CANADAIR recently announced the existence of their CL-41 Trainer, a side-by-side, low-wing basic trainer with nose-wheel undercarriage and powered by "an advanced lightweight turbojet" of about 2,000 lb thrust. Weighing 6,250 lb, the Trainer should take off after a ground-run of 1,000ft, stall at 62 kt, have a maximum speed of 400 kt and travel 800 n.m. at 300 kt with 10 per cent fuel reserve. Wing area and loading are 220 sq ft and 28.4 lb/sq ft; and span and length are 36ft 4in and 31ft 11in.

Two prototypes are to be completed next autumn. R.C.A.F., U.S. Navy and U.S.A.F. teams have inspected the mock-up and the aircraft has been designed to meet both British and American spin requirements and R.C.A.F. training specifications. Pressurization, duplicated instrument panels, fully automatic ejection seats and a bird-proof windscreen are features of the aircraft. Except for having a T tail and a single engine, the CL-41 bears considerable resemblance to the Cessna T-37.

Exports Indian Summer

SO far this year India has been Britain's best customer for aviation exports, heading the list for the first ten months with purchases amounting to £5,531,220 and for October with £1,359,274. The second biggest customer so far this year has been Sweden (£5,423,858), followed by the U.S. (£4,674,842), the Netherlands (£3,328,454) and Canada (£2,918,454).

During October, aviation exports amounted to £9,192,714—the fourth highest monthly total for 1957—compared with £8,531,445 for the same month last year. The figure was made up as follows: complete aircraft and parts, £5,180,278; aero-engines, £3,488,587; electrical equipment, £299,473; instruments, £169,057; tyres, £55,319.

The recent Swiss order for Hunters, worth £26m, is the tenth so far received by Britain for military aircraft this year and brings the 1957 total to almost £100m for some 460 aircraft.

FLYING TRIANGLES

TWO new flying films, both made by Universal-International, are being released for public showing this month. The first, *Tarnished Angels*, is based upon William Faulkner's surrealist novel *Pylon*, and concerns U.S. air racing in the post-depression days of 1932 when money was tight and (the plot would have us believe) morals were loose. Love's eternal triangle, which surrounds Roger Schumann, Lafayette Escadrille, his stunt-parachuting wife and his trusty mechanic, soon becomes a quadrangle when an idealistic, whisky-drinking newspaperman starts to probe their story—"Their veins run with crankcase oil . . ."

The Mardi Gras (always good value when a macabre touch is needed), a newspaper office where the editor is little concerned with "flying gypsies who sleep under their planes and tour the air race circuit," and a showground at New Orleans airport, form the backdrop to the rather brief air racing action, but the film gives some tantalizing glimpses of American air racing specials, all of which are eclipsed in the first race by the 60G Moth belonging to the stern, silent Schumann. He's a man who rarely talks and never smiles except when in the air, but then he's "got a hunger for the flying machine." The racing scenes are a composite of the genuine and the faked, and both of the speeded-up races which are shown end in fatal crashes. No wonder, when the angry young competitors knock pieces out of the sides of the pylons with their wingtips—Coventry was never like this.

So dangerous is this air racing that before one event the clerk of the course insists upon an inspection of a borrowed aircraft, which has been patched up by Schumann's mechanic Jiggs after all-night work on a faulty electrical system, but the doubtful wisdom of limiting the check to persuading the engine to run is made only too clear. . . .

Love, whisky and good newscopy have their slightly jaded triumph in the end. The heroine buys a ticket back to the farm in Iowa (all the best Americans have country backgrounds) in a Lockheed Vega, Jiggs takes to alcohol, and the bewitched reporter returns to his office to persuade his editor that some blood at least runs in the oily veins of the air racing fraternity.

The Lady Takes a Flyer (alternative titles have been *A Game Called Love* and *Wild and Wonderful*) is a picturesque burlesque of Fleetway, Inc., the ferry service operated by Mary and Jack Ford. The latter, as technical adviser, must be held responsible for some shenanigans that would certainly cause the Civil Aeronautics Administration to raise an administrative eyebrow—a proposal over the radio of two B-25s on a delivery flight is but a part of it. But the colour is so good, and the flying scenes have all the lightheartedness that comes from leaving the clouds below, that the many absurdities of the story can almost be forgotten. Indeed, Cupid's darts seem to be shot in every direction, and even before the new "Skyways Aircraft Ferrying Service" is formed by the two reunited ex-U.S.A.F. chums, the ex-ferry pilot woman flying instructor is well on the way to changing her allegiance.

The ferrying service, run with tremendous enthusiasm on the most casual lines, provides plenty of opportunity for some good shots of Privateers, B-26s, B-29s, Commandos and so on, including those in the great American desert graveyards where the air is so dry that airframes left there at the end of the war are still bright in their squadron paint.

One might wish that the dialogue was as attractive as the photography, but at least stay-at-homes who see this film will be reminded that family ties needn't really be a bar to running a ferry service: you can always take baby with you. A.T.P.

Value for money: the comfort of the Boeing 707, due into trans-atlantic service in 1959, is here compared with the Lancastrian of 1947.

DOWN WITH AIRLINE FARES

The Background to I.A.T.A.'s Big Decision

AFTER weeks of wrangling at Cannes in the autumn of 1956 and at Miami and Paris in the last two months, the International Air Transport Association—as we recorded last week—have at last agreed on the fare changes to be introduced next spring when third-class services are introduced.

In the spring and summer of 1956 a movement to obtain higher North Atlantic fares was gaining force among I.A.T.A. airlines. This was given expression shortly before the 1956 Cannes conference with the issue of a report, sponsored jointly by B.O.A.C., T.W.A. and K.L.M., stressing the steady increase of operating costs and emphasizing the need for increased revenue rates. At first sight these are not the airlines which might be considered the main supporters of higher fares. But B.O.A.C. were suffering from restricted capacity, T.W.A. were undergoing a period of financial distress, and K.L.M. were anxious to improve their relationship with prospective shareholders.

The U.S. Civil Aeronautics Board wasted no time in stating its attitude: not only was C.A.B. firmly opposed to an increase in North Atlantic fares, but favoured the introduction of a third-class service in addition to existing standard and tourist services.

The delegates left Cannes, having accepted C.A.B. policy; third-class fares would be introduced on April 1, 1958. The "key" North Atlantic single fare, London-New York, was set at $232 (£83), equivalent to a reduction of 20 per cent on existing tourist fares. It was agreed to delay final decisions on standards of service for the new third-class, and on possible amendments to first-class and tourist services, until the Miami conference in 1957.

But after three weeks of debate at Miami "differences of opinion" still existed, although there was "no disagreement on the intention of starting the new low-fare service." And remarks made by various airline spokesmen, before adjourning to Paris, indicated that the new fare would be 20 per cent cheaper than the existing tourist fare.

Before and during the Miami conference, discussions on fare changes had usually been based on operating-cost changes. The usual argument put forward was that inflation was creeping up on air transport, and that further fare concessions were inappropriate: indeed, in the face of rising surface fares, unnecessary.

After the Miami conference a swing of emphasis could be detected. The opinion was increasingly expressed that fare reductions would be financially detrimental to the airlines' massive new equipment programme. The explanation of this change of emphasis probably lay in the difficulty of producing acceptable statistics to show that operating costs were in fact rising: greater productivity is largely, if not wholly, counteracting inflation. (Prof. Brewer's recent report for Boeing noted that units of output for airlines increase at a faster rate than units of labour input; in brief, that air transport is becoming increasingly mechanized.) One item of expenditure, depreciation, could be shown to be on the increase: not as a result of inflation, but of a deliberate airline policy to render existing piston aircraft obsolete by ordering jets.

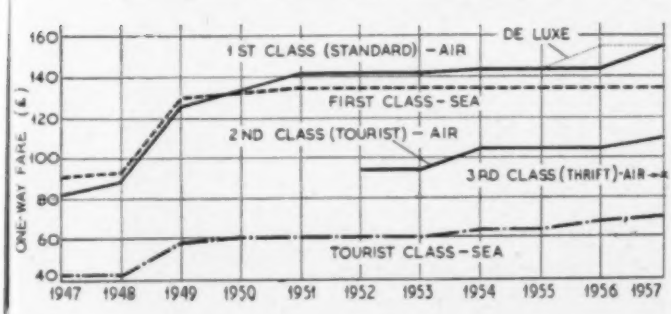
The airline representatives met again in Paris in what was described as an atmosphere of crisis—B.O.A.C. stated that they were likely to lose about £½m on the North Atlantic route this year because they could not raise fares. The Paris conference was planned to continue "until agreement is reached." In just over a week the exhausted delegates were able to disperse, with the standards of service more or less agreed and the new fare levels established. The new so-called "economy" fare was advertised as being 20 per cent below the tourist level. This referred not to the existing tourist fare but to the revised tourist rate which would apply after the "economy" fares were introduced. The actual reduction on existing tourist fares was only 13 per cent. Those airlines who went to Paris with the intention of pressing for a reduction of 20 per cent on the lowest existing fare had to make concessions in order to avoid the possibility of an open situation. Under the original scheme the London-New York third-class single fare was to have been £83. Under the new scheme it will be £90.

Yet there remains the possibility of the C.A.B. standing adamant on the original interpretation of a "20 per cent reduction in tourist fares." Only the agonies that I.A.T.A. have already undergone will make such a stance unlikely.

Viewed against steadily increasing ocean fares, the new "economy" service offers a strong incentive to a wide section of transatlantic passenger traffic to desert the sea and take wing. There is real need to increase the rate of North Atlantic air-traffic growth. The growth in recent years has been largely maintained by resorting to devices such as concessions for Servicemen and immigrants.

The backbone of the North Atlantic market consists of Americans and Canadians coming to visit Europe, and thus a comparison of eastbound traffic over the first half of each year is a most useful measure of growth. The table on page 934 shows that this traffic increased in 1957 by only nine per cent over 1956. Unless the third-class fare is introduced next spring, the rate of increase for 1958 will probably be even less than this. (This table also shows

Continued on page 934



Left, the post-war history of North Atlantic air and sea fares; and, right, B.O.A.C.'s forthcoming Britannia 312 London-New York schedule compared with their Constellation schedule of 1947.

B.O.A.C. LONDON–N.Y. TIMETABLES
(All times G.M.T.)

1947	
Constellation L-749	
London	dep. 21.00
Shannon	arr. 23.15
Shannon	dep. 00.45
Gander	arr. 10.45
Gander	dep. 12.15
New York	arr. 17.30
Elapsed time (hr)	20.30
1957	
Britannia 312	
London	dep 10.30
New York	arr. 22.30
Elapsed time (hr)	12.00

PASSENGER'S EYE VIEW from a Bell 47G-2 approaching Eastleigh (Nairobi) Airport. Flown by Mr. Lincoln Lord, managing director of Autair, Ltd., the helicopter had been on a trial flight preparatory to a power-line-patrol contract. Autair (Africa), Ltd., were recently appointed sales representatives for Bell helicopters in the area.

HERE AND THERE

Swiss Hunter Order Postponed

A DECISION by the Swiss Government to purchase 100 Hawker Hunter 6s—reported in our issue of November 22—was postponed last week when it was decided to discuss the matter further on January 28.

Hebrides Range Cutback

"CONSIDERABLE curtailment" of the scheme for a missile range in the Hebrides has been announced by the Minister of Defence. The scheme, which was to have cost £20m, will now cost £5m and will provide facilities for surface-to-surface firing only. It is considered that the facilities at R.A.E. Aberporth and the Army range at Anglesey are adequate for the testing of air-to-air and surface-to-air missiles.

Safety in the Service

THE R.A.F. accident-rate has again gone down during the past year. This was announced by Air Marshal Sir Geoffrey Tuttle, Deputy C.A.S., at the Air Ministry last week, with the comment that this continued a downward trend which had been continuous since the birth of the R.A.F. Actual figures are not normally made public.

Silver Dart Replica

AMONG tentative plans for commemorating the 50th anniversary of powered flight in Canada is a re-enactment at Baddeck Bay, Nova Scotia, of the Hon. J. A. D. McCurdy's take-off from the ice there on February 23, 1909, in Alexander Graham Bell's Silver Dart—a full-scale piloted replica of which is being built by the R.C.A.F.

H-3 C. of A.

AN airworthiness certificate has been issued to the Nederlandse Helicopter Industrie's Kolibrie H-3. Some Kolibries are now in production for use in New Guinea and for spraying duties in Holland.

Back to Germany

LARGE numbers of British and German soldiers and civilians attended a ceremony at which a former Luftwaffe airfield at Celle-Weitzenbruch, which had been in use by the R.A.F. since 1945, was handed over to the West German Air Force.

Fourteen for the Ferry

FOURTEEN Avro Aircraft CF-100s will be flown across the Atlantic from the R.C.A.F. station at Uplands later this month. They are the first of a batch of 53 being supplied to the Belgian Air Force under the joint Canadian - United States mutual aid plan.

Poetic Injustice

THE inventor of the "scoop-net" helicopter air/sea rescue device, Lt-Cdr. John Sproule, was himself in need of assistance when his helicopter descended into Southampton Water while on a night-flying exercise. He was rescued—by boat.

European Aeronautical Conference

IN Brussels next year (September 22-27) the third European Aeronautical Conference is to be held under the patronage of AICMA (International Association of Aeronautical Manufacturers). It will be organized by the aviation group of the Brussels Universal Exhibition in collaboration with GEBECOMA, the Belgian division of the international association. Details can be obtained from the Conference Secretariat, 1470 Chausée de Haecht, Haren, Brussels.

TWO WIDGEONS are shortly to work in the Persian Gulf with Bristow Helicopters, Ltd., who are to operate them under charter from the British Petroleum Co., Ltd. Mr. and Mrs. Alan Bristow are seen with one of the eye-catching new Westlands before its shipment. With them (right) is Mr. David Collins, works director of Westland Aircraft, Ltd.

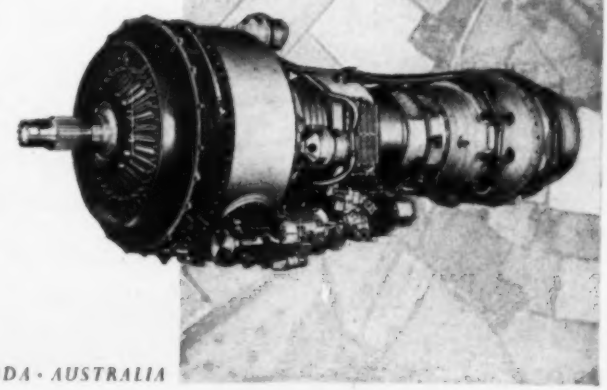
Belfast in the Future

A DEPUTATION of four M.P.s, representatives of the Association of Engineering and Shipping Draughtsmen, and of the Short Brothers and Harland works committee was received last week by Mr. Aubrey Jones, Minister of Supply, and Lord Glentoran, Northern Ireland Minister of Commerce. Its purpose was to discuss the future of the company in view of the labour situation in Northern Ireland and the technical loss due to dismissal of skilled labour. The Minister emphasized that nearly all Transport Command's Britannias were being made by the firm and undertook to accelerate decisions on requirements which Shorts might fulfil.

MEMORIAL to a pioneer: On the grave of Graham Gilmour at Mickleham, Surrey, may still be seen this representation (a not very accurate one) of the Martin-Handasyde monoplane which he was flying when he met his death in a crash in the Old Deer Park, Richmond, Surrey, on February 17, 1912, while on a cross-country flight from Brooklands.

ROLLS-ROYCE
TYNE
PROP-JETS
power the
VICKERS VANGUARD

Vanguards have been ordered by British European Airways and Trans-Canada Air Lines



The Tyne is an advanced twin spool high compression engine in the 5,000 h.p. class. It has been designed to give a very low specific fuel consumption and is backed by the unique experience gained by Rolls-Royce in more than 3,000,000 hours operation of gas turbine engines in scheduled airline service.

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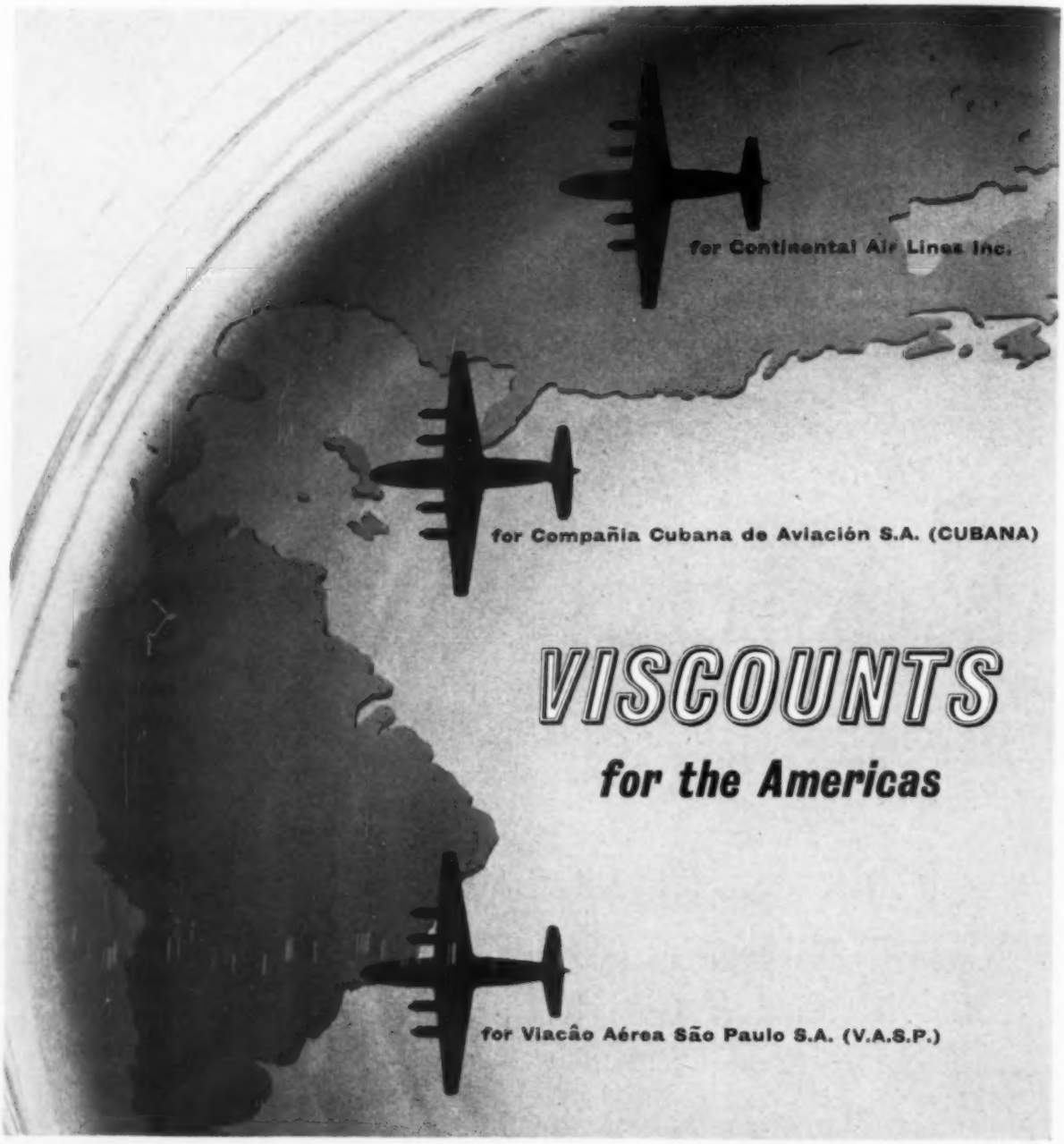
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for Viacâo Aérea São Paulo S.A. (V.A.S.P.)

GOODYEAR AVIATION PRODUCTS

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THE GOODYEAR TYRE & RUBBER COMPANY (G.B.) LIMITED · AVIATION DIVISION · WOLVERHAMPTON

THE AERONAUTICAL BOOKSHELF

"Operation Vanguard" by Werner Buedeler. Burke Publishing Company, Ltd., 55 Britton Street, Clerkenwell Road, London, E.C.1. Illustrated. Price 16s.

"The Making of a Moon" by Arthur C. Clarke. Frederick Muller, Ltd., Ludgate House, 110 Fleet Street, London, E.C.4. Illustrated. Price 21s.

IT would be difficult to review these two books separately. They are both published at the same time, they are both an introduction to earth satellites and they both need some revision in view of *Sputniks I and II*. "In due course," Mr. Buedeler says in *Operation Vanguard*, "American experts will announce the orbits of the satellites" and as a result thousands of people would see man's "first" vehicles in space. Later he says: "In the U.S.S.R., apparently, plans are not yet sufficiently advanced for us to learn what the orbit or orbits of their satellites will be."

We may smile at these wrong predictions, but the blame cannot be laid at the door of the two authors. The magnificent Russian achievement has surprised everyone—except probably the Russians—and in the light of their success these two books are tremendously useful and timely. A wealth of simply stated information will help both laymen, and the more technically minded, to understand how satellites work.

Operation Vanguard is perhaps the simpler of the two, and might be regarded as an introduction to Sputnikery, while Mr. Clarke's volume is slightly more technical, though still easily understood and excellently illustrated with all-American pictures. *The Making of a Moon* is usefully indexed too, and contains more of the history of the preparation of the American satellite programme. How useful it would be if an enterprising publisher were to get a similar book from Russia about how the programme there was brought to fruition. A.C.B.

"Ships in the Sky," by John Toland. Frederick Muller, Ltd., Ludgate House, 110 Fleet Street, London, E.C.4. Illustrated. Price 21s.

FROM Santos-Dumont to Eckener, from the *Shenandoah* and the *Italia* to the R.101 and the *Hindenburg*, airships and their designers have always exercised a peculiar fascination on the public mind. This was partly because so few dirigibles were built (compared with the numbers of aeroplanes) that each developed an individual personality, its name and exploits catching popular attention. The fascination of airships also arose from the sad fact that so many of their limited number met horrible ends with great loss of life. The *Shenandoah* was torn in three by a line squall; R.30 broke apart over the Humber; the R.101 suffered a fiery death at Beauvais; the *Italia* was never seen again after its control-car broke off and crashed on the Arctic ice; and the *Hindenburg* disintegrated in flames when securing at New York after a successful Atlantic crossing.

Yet though they were involved in so many disasters, airships also made many remarkable flights. In 1917 the German L-59 flew 4,225 miles from Bulgaria to the Sudan and back non-stop without incident; the R.34 and the R.100 both completed double Atlantic crossings, likewise without incident; and the Germans made international airship services a commercial success.

Now only the U.S. Navy's blimps remain as tangible reminders of aviation's lighter-than-air era, whose triumphs and tragedies John Toland has painstakingly recorded in a book which should appeal equally to airship enthusiasts and to aeronautical connoisseurs. H.W.

"Man Unlimited," by Heinz Gartmann. Jonathan Cape, 30 Bedford Square, London, W.C.1. Illustrated. Price 18s.

TRANSLATED from the German by Richard and Clara Winston, this is a record and discussion of modern scientific achievement—not all aeronautical, but all fairly familiar to us. It is the sort of book which exhorts young men and women to make use of modern science, and to help to lead their countries into the ranks of the scientifically minded nations of the world.

"Flight Today" by J. L. Nayler and E. Ower. Oxford University Press, Amen House, Warwick Square, London, E.C.4. Illustrated. Price 12s 6d.

HERE is a useful introduction to aeronautics which, in this fourth edition, has been brought right up to date with concise and reasonably elementary explanations of the principles of such things as vertical take-off, convertiplanes, guided weapons and the organization of the airways systems. The authors have carefully avoided using too technical language, so the book may be understood by fathers as well as by their young sons. The diagrams, too, are straightforward and easily understood.

"An A.B.C. of Aeronautics" by L. L. Beckford, Cassell and Company, Ltd., 37/38 St. Andrew's Hill, London, E.C.4. Illustrated. Price 15s.

WHAT is an accelerometer? What is meant by a free turbine? What does a gyro do? The answers are in *An A.B.C. of Aeronautics*, a book which should be particularly useful to the ever-growing number of people who read aeronautical literature but are baffled by the new words and phrases they meet. Aeronautics, like other industries, has surrounded itself with a language of its own. This dictionary is an able interpreter of the everyday language of test pilots, aircraft designers and engineers.

OTHER BOOKS RECEIVED

High-Speed Aerodynamics, by Prof. Dr. Elie Carafoli. Pergamon Press, 4-5 Fitzroy Square, London, W.1. Price £5.

Sight Reduction Tables for Air Navigation, Vol. 1. H.M. Stationery Office. Price 25s.

Aircraft Hydraulic Design, by George R. Keller. The Industrial Publishing Corp., 31 Palace Street, London, S.W.1. Price 32s 6d.

"Glorious," by Stanley Devon. George G. Harrap and Co., Ltd. Price 18s.

Gas Turbine Materials, by G. Lucas and J. F. Pollock. Temple Press, Ltd., Bowling Green Lane, London, W.C.1. Price 25s.

The History of Flying, by Charles H. Gibbs-Smith. Cambridge University Press, 200 Euston Road, London, N.W.1. Price 3s.

Zusammensetzung und thermodynamische Funktionen chemisch reagierender Feuergase von Kohlenwasserstoff-Luftgemischen, by H. J. Kaeppeler and G. Baumann. Verlag Flugtechnik Stuttgart, Rankestrasse 23, Stuttgart-Sillenbuch.

Wonderama, by Angela Croome, edited by Eamonn Andrews. Adprint, Ltd., 37 Hertford Street, London, W.1. Price 7s 6d.

Wings of Youth, poems by Leonard Taylor. Rolls House Publishing Co., Ltd., 2 Breams Buildings, London, E.C.4. Price 12s 6d.

Flight Overseas, by Henry B. Lent. The Macmillan Company, 10 South Audley Street, London, W.1. Price 21s.

The Brockbank Omnibus, by Russell Brockbank. Michael Joseph, Ltd., 26 Bloomsbury Street, London, W.C.1. Price 21s.

Jet Aircraft Power Systems (2nd edition), by J. V. Casamassa and Ralph D. Bent. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. Price 60s.

British Battleships, by Dr. Oscar Parkes. Seeley, Service and Co., Ltd., 196 Shaftesbury Avenue, London, W.C.2. Price 6 gns.

TITANIUM ELECTROPLATED

A NEW YORK report says that laboratory experiments by the U.S. National Bureau of Standards have indicated the practicability of electroplating, on a commercial scale, light metals such as magnesium, titanium, zirconium (and their alloys) from solutions.

Deposits are obtained by electroplating the metals or their alloys from organic solvents. Until now electroplating of these materials has not been commercially practicable, because the metals could not be deposited from aqueous solutions in normal fashion. Plating from a bath of molten light metals also proved generally unsatisfactory, resulting only in a deposit of flakes or particles.

National Bureau of Standards workers dissolved complex compounds of the metals in ether, ethyl alcohol and other organic or organo-metallic solvents and plated from these solutions. After studying and eliminating many solvents, some of them too dangerous for commercial use and others not chemically satisfactory, they found the ethers, particularly ethyl ether, to be the most effective for organic plating baths. Boro-hydrides, hydrides and halides proved to be the most amenable solutes.

The experiments also indicated that commercial applications of the process could make use of economical conveyer systems rather than fixed-electrode and batch-production methods.

GARRETT'S GENEVA OFFICE

AN office has been opened in Geneva by the Garrett Corporation to give European customers more direct service and provide additional liaison with companies with which it has licensee manufacturing agreements. On the staff at Geneva are Mr. B. S. Clark (formerly of Rotol, Ltd.), as the Corporation's senior foreign representative; Mr. H. W. Whitelock, foreign operations representative; Mr. John Q. Adams (primarily working for Garrett's AiResearch Aviation Service Division as sales representative for its "Maximiser" kit for DC-3 aircraft) and Mr. Warren J. Sweetnam, field service representative for Garrett's AiResearch manufacturing divisions.

Tu-114

WRITING in *Flight* of November 29, Mr. F. H. Robertson, A.F.R.Ae.S., chief project engineer of Short Bros. and Harland, Ltd., summed up his impressions of the Soviet Tu-114 transport with the remark: "All I can say about this very fine aeroplane is that I wish we had built it!" Presented here are more intimate glimpses of this aircraft. Above, a section of the rear cabin (54 seats). Top right, the central cabin (48 seats). Right, one of the men's washrooms. Far right, one of the three cloakrooms. Below, another aspect of the central cabin. Lower right, one of the three stewardesses using the intercom.

PORTUGAL'S AIRLINE

The Varied Operations of T.A.P.

"FLIGHT" PHOTOGRAPHS

Most Super Constellations using London Airport belong to the long-haul fraternity on north-side. London Airport Central is here the scene, however, as the last passenger leaves a T.A.P. Super-G from Lisbon.

THE recent introduction of Lockheed L.1049G Super Constellations on the Lisbon-London and Lisbon-Paris routes of Transportes Aéreos Portugueses coincided with the airline's announcement of its intention to purchase three Vickers Viscount 810s, which should enter service next year. A relatively small airline with a widespread route network involving both long-range and short-range problems, T.A.P. is at present moving ahead at a modest rate, tailoring closely its re-equipment and route-expansion programme to realistic estimates of traffic density.

The airline has six scheduled services, which fall into three categories. The only long-range service is that from Lisbon to Lourenço Marques, Mozambique, with stops at Kano, Leopoldville and Luanda. Medium-length stages comprise services from Lisbon to Paris and to London; while the shorter flights are those to Madrid, Tangier and Casablanca, and (the only scheduled internal service) to Oporto.

To serve these routes, T.A.P. has a fleet of six DC-3s, three DC-4s and three L.1049G Super Constellations. The Super-Gs now fly to London, Paris and the long haul to Africa; the DC-4s serve the Madrid line; and DC-3s are used on the Oporto and Tangier/Casablanca services. One of the DC-3s is operated by D.T.A., the Portuguese West African airline, on feeder services between Luanda and the island of Sao Tomé. Originally government-owned, the airline was formed in 1944 and opened its first service, by DC-3 to Madrid, in September 1946. The DC-4s followed, and these were replaced by L.1049Gs on the African service in November 1955. This was the result of a re-equipment programme which followed the establishment of the airline as a private company (in which the Portuguese government retained an interest of more than 50 per cent) in 1953.

During last year T.A.P. carried 42,341 passengers and 515 short tons of freight, the airline's total product being 6,075,000 short-ton-miles flown. The DC-3s flew 2,231 hr, the DC-4s 3,174 and the Super Constellations 4,349. The highest passenger load factors were 77 and 75 per cent, achieved by the DC-3s on the Tangier-Casablanca and (up to May 23) Madrid routes. Overall passenger load factor was 46 per cent. Based on a level of 100 at June 1953, the monthly index of ton-miles offered had risen to 572 by September 1956.

On October 8 of this year the L.1049Gs were introduced on the routes from Lisbon to Paris and to London, and it was shortly after this that *Flight* was invited by T.A.P. to sample this service. At the Lisbon end an intensive touristic programme had been organized, including visits to the Port Wine Institute and other worthy establishments, and it was unfortunate that a powerplant snag on our Super-G at London Airport should have forced us to postpone our departure by some 20 hours.

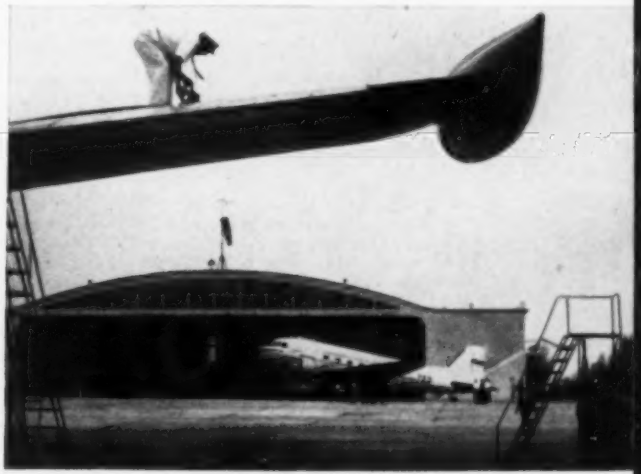
This forcibly emphasized one of the basic problems for any airline operating a small fleet through bases where the low frequency of operation precludes the permanent employment of the airline's own staff, with spares and equipment. At London Airport, for instance, the maintenance of T.A.P.'s Super-Gs is carried out by Air France (and traffic handling, as would be expected, by B.E.A.).

The flight from London to Lisbon took 3 hr 45 min (compared with a scheduled 3 hr 55 min for B.E.A. Viscounts). Until the introduction of the Super Gs, T.A.P. were operating their DC-4s on the London-Lisbon service; and these aircraft had the difficult job of competing, since October 1955, with B.E.A. Viscounts on the same route.

Having briefly sampled the gastronomic, musical and other attractions of the city of Lisbon, we visited the T.A.P. operations and engineering base at Lisbon Airport. Here we were able to discuss with Lt-Cdr. Roger de Avelar, operations superintendent, some of the background factors influencing the airline's current operations and future planning. Two basic factors which contrast sharply are that, while Portugal itself does not generate a great deal of international air traffic—the country is not as industralized as, say, Belgium or the Netherlands—Lisbon airport is an extremely busy transit centre. To use a familiar and overworked cliché, Lisbon is a "gateway to Europe"—a phrase which takes on real meaning, particularly for traffic from South America and Africa, when one looks at the globe.

The density of air traffic to and from Portugal is not great, and

At the other end of the London - Lisbon service, these apron views of T.A.P. aircraft at Lisbon show (left) one of the L-1049G Super Constellations and (right) a DC-3 in front of one of the two main T.A.P. hangars. The DC-3s are used on services to Oporto and Tangier/Casablanca.



Views of, and from, the airport terminal building at Lisbon. Super Gs of T.A.P. serve London, Paris and the long-haul route to Africa at present: Lisbon Airport itself retains a high importance as a European gateway, particularly for South American and African traffic.

PORTUGAL'S AIRLINE . . .

an airline such as T.A.P. is in no position to embark on ambitious and expensive re-equipment programmes beyond its means. The purchase of three Viscounts clearly makes sense; they are intended for the highly competitive European routes (London, Paris and Madrid), on which they should begin to operate in about one year's time. As mentioned, these routes have until recently been flown with DC-4s, and it was as a replacement to the DC-4, which has given good service over many years, that the Viscount was selected (after evaluation of a number of possible types). The operation of the Super Gs to London and Paris is essentially an interim measure.

Present planning envisages a sufficiently large traffic increase on the London, Paris and Madrid routes to keep the Viscounts busy on these services alone. Expansion of this medium-stage route network would depend primarily on this factor, but remains a possibility. The traffic potential on the short-haul routes does not justify the introduction of another new type—such as, say, the Friendship—in the immediate future.

Although the numbers involved are small, the problem of a supply of suitable pilots has affected T.A.P. as it has the larger airlines. The Portuguese Air Force has co-operated with the company, and a number of ex-national service pilots have been taken on by T.A.P. and trained to commercial-licence standard. At present the airline has a total of 30 pilots (plus 7 under training), 11 navigators, 15 radio officers and 17 flight engineers. The total number of employees is 886.

On the technical side, Lt-Cdr. de Avelar emphasized, T.A.P. as a small operator has reaped the benefit of its I.A.T.A. membership in many ways. This includes the continuous exchange of information by means of I.A.T.A. meetings, and also by visits to the larger and more experienced airlines to discuss approaches to common problems. Thus T.A.P. is able to keep technically up to date without maintaining a large staff, which would certainly be difficult to recruit and would constitute a heavy economic burden in carrying out detailed investigations from scratch.

During the first two years of operating the L.1049G, Transportes Aéreos Portugueses has run into a number of teething troubles associated with the introduction of a complex aircraft fitted with high-power engines (3,250 h.p. Wright DA-3 Turbo-Compounds). Engineering and operational effort is now switching from this problem to that of preparing for the introduction into service of the airline's Viscounts. On the maintenance side, T.A.P. engineers at Lisbon handle the aircraft of Air France, Alitalia, Avianca, B.E.A., C.P.A.L., L.A.V., Lufthansa and Swissair. Also handled are traffic and operations for these eight airlines and for Aerolineas Argentinas, Flying Tiger Line, Cubana, Iberia, and Sabena.

Lisbon Airport, which last year handled a total of almost 21,000 aircraft movements (12,600 of which were by commercial aircraft), is used regularly by no fewer than 21 international airlines. Among their services are those connecting the Portuguese capital directly with South America, Africa, U.S.A., Canada and various European cities. A high proportion of passengers using the airport are in transit; the statistics for 1956 included 101,700 transit passengers compared with 156,000 arriving or departing.

The airport facilities include I.L.S., V.O.R. and M/F range and non-directional beacons. The V.O.R. equipment is in operation but its permanent location on the airfield has not yet been decided. Lisbon traffic is increasing and there are a number of military airfields in the vicinity; accordingly surveillance radar equipment is to be added in the near future. It is also possible that G.C.A. may be installed.

While runway strengths and lengths at Lisbon are at present adequate for all current civil transports, the problem of planning for the era of the heavy jets has not been overlooked. A committee has been formed to advise the Portuguese government on the steps which should be taken to ensure the continued international importance of the airport.

Lisbon's instrument runway, 23, is at present 6,820ft long. It is expected that this may be increased to 11,000ft and a second runway to 7,000ft as part of the forthcoming development programme, work on which should start next February. While Portugal's own airline will not be among the first operators of the long-range jet transports, it is the firm intention that Lisbon should retain its European gateway position. K.T.O.

ARMCHAIR AERODYNAMICS

A B.B.C. television programme, *Wing of the Future*, on November 21, in the series *Eye on Research*, dealt in some 25 minutes with wind-tunnel work at the Royal Aircraft Establishment at Bedford. The programme conveyed an effective explanation of the work of both the low-speed and 8ft-section high speed tunnels. The cameras were allowed to range over an exciting variety of aircraft and missile shapes, and one of these—a model with sharply swept-back wings and tailplane, straight trailing-edges and jet pods mounted on the wing tips and on stubs from the rear fuselage—was chosen to illustrate typical problems that might be encountered.

The same model, built to different scales, was used in both low-speed and high-speed demonstrations. In the former, airflow was demonstrated with smoke canisters and a pressure manometer of the type in which the information is transferred to punched cards. After an explanation of the function and design of the high-speed tunnel with the aid of a model, and illustrating briefly the type of probe and balance used, the airflow over the model aircraft in the working section was accelerated to Mach 1.6 and the shock-waves demonstrated by aid of a Schlieren screen. The model was rolled through 90 deg and—rather too briefly—the formation and position of the shock waves were discussed. The fact that the wave pattern was not ideal gave those in charge of the wind tunnels an opportunity to discuss with the interviewer the steps that they would take to put matters right. They were prepared to admit that additional consideration would have to be given to scale effect and to the tunnel results before the hypothetical aircraft designer was asked to make a change in the tailplane position.

1956—Fairey flew fastest

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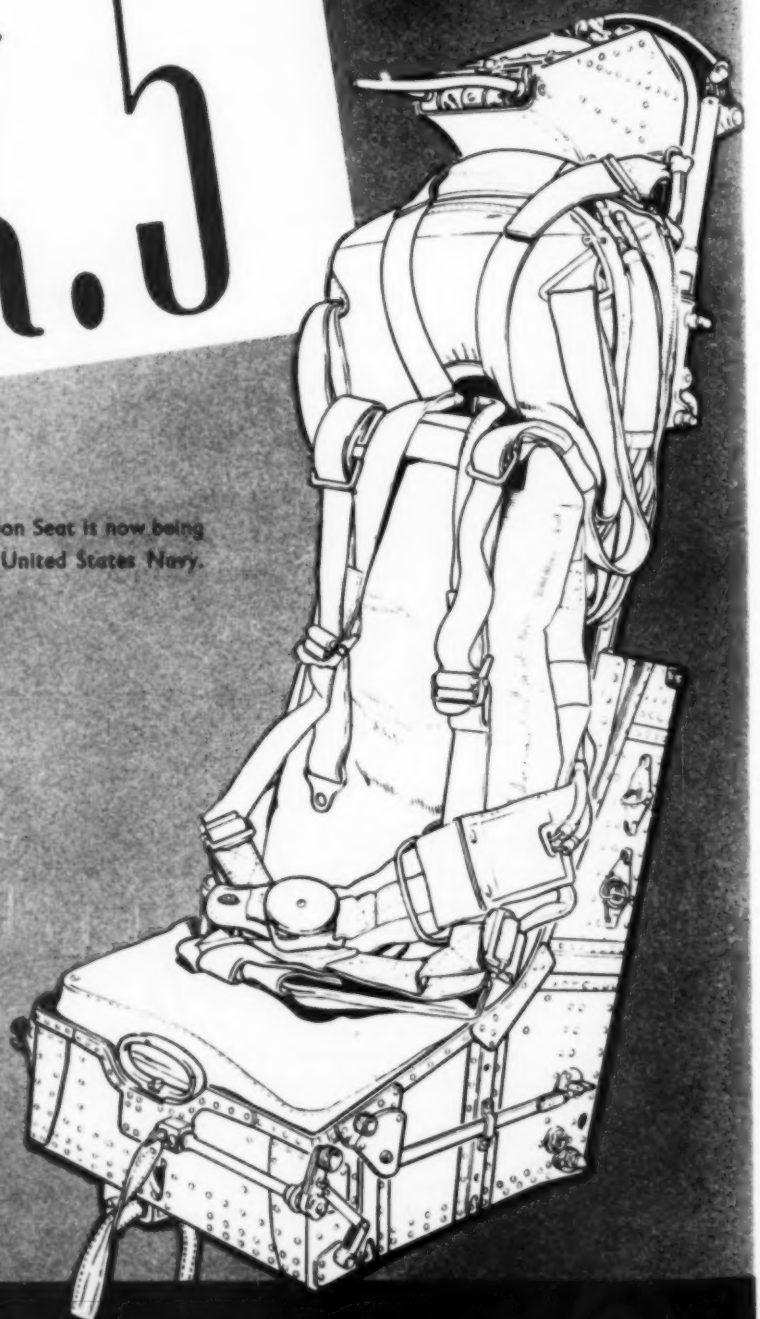
Mk.5

The Martin-Baker Mk.5 Ejection Seat is now being delivered in quantity to the United States Navy.



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Britannia in Service

Statistics Tell the Story

Right, subject of this story—the B.O.A.C. Britannia 102.

NO other aircraft now in airline service has had to operate in the continued glare of limelight accorded to the Bristol Britannia 102. Introduced on to B.O.A.C. routes on February 1 this year after a series of frustrating delays, it has since been the subject of some sharp criticism. How much of this has been justified and how much tendered as the result of hypersensitivity about the prestige of British transport aircraft may be judged from this summary of a lecture by Dr. A. E. Russell, a director and chief engineer of Bristol Aircraft, read to the Bristol Branch of the Royal Aeronautical Society on December 5. Supported by statistics provided by the operator, it presents the most complete and balanced survey of the first eight months of Britannia operation yet published.

OPENING his paper with a summary of the steps which led to the design of the Britannia, Dr. Russell traced the history of the specification up to the time the formal contract with B.O.A.C. was signed in July 1949. The first flight, with Proteus 625 engines installed, was made in August 1952, and at the end of 1953 the second prototype, with Proteus 705s, made its first flight. Two months later, a forced landing as the result of an engine fire (due to a reduction gearing failure) caused a setback rendered more severe by the fact that the first prototype had then to be converted to production standard. Further delays in delivery were caused by a B.O.A.C. decision not to accept any aircraft until a full C. of A. had been granted and later, ice accumulations in the engine air intakes introduced a new and formidable problem. By the time the first Britannia 102s entered service, 4,150 hr of test flying had been performed.

By the time [continued Dr. Russell] a civil aircraft has passed through its initial flight development programme, exceeding (in the case of the Britannia) four thousand hours in the air, it has been handled by a considerable number of expert and critical crews. Many hundreds of thousands, if not millions, of figures are stored in records, a large proportion of them extracted and plotted in a form to demonstrate compliance with the many details of the specification. The airworthiness authorities also have fretted and speculated with the greatest determination to foresee a combination of faults, overlooked by the designers, which might possibly lead to an emergency. In the final phase the aspect of aircraft performance covering the recognized conditions of engine and component failure has been fully documented for the benefit and instruction of its future operational crews.

Notwithstanding this care and attention to detail, it is certain that the gruelling environment of operational service will show that certain presumed cures for previous maladies were incomplete, while other dormant hazards become active. The early periods of passenger carrying operation are, therefore, the most testing of all. In this stage popular interest usually emphasizes aspects of glamour and prestige, so diverting attention from the engineers concentrating upon the task of setting and keeping the machinery in order.

Statistics of the reliability of aircraft and their equipment in service are difficult to come by. Airlines are generally peculiarly reticent on these matters. It would seem that they would prefer to have the casual passenger infer that his experience of delay is unique, and those who travel more frequently are made to feel grateful for the good care taken of them. Amongst this latter group one finds from personal experience that a fair proportion are themselves engaged in some branch of aviation and have thus become conditioned on their own airfields to waiting for something to happen. So if the unique occasion arises when an airline publicizes frequent service delays due to the unreliability of its latest aircraft—the consequence of which is in effect to advise its potential customers to travel with a rival operator—something somewhere must be amiss.

Now a fair judgment of reliability in service can only be reached by making comparisons with the standards reached by other aircraft at a similar stage in their operational life. The gathering of evidence is, however, made difficult by the limited amount of published information. Some is provided by a paper entitled "The Comet in Service," read by Campbell-Orde before the Fourth Anglo-American Conference in London, 1953; this has been augmented by information including all types in their fleet which B.O.A.C. has recently provided. Figs. 1, 2 and 3 are based upon these sources, with Britannia curves added where required for purposes of comparison.

Fig. 1 shows aircraft utilization obtained by dividing the total number of hours flown by the total number of aircraft in the fleet and Fig. 2 shows the cumulative revenue miles flown per aircraft; in these two respects the Britannia appears to perform quite creditably. Fig. 3 gives a comparison of terminal punctuality between Comet, Argonaut, Stratocruiser and Britannia; this information suggests that punctuality is not a typical virtue of new aircraft. I don't know what impressions you get from these results, but I assure you that the curves have not been drawn upside down.

We now turn to America for some experience. After its first year of passenger operation, it was found that the Lockheed 1049C had reached an average daily utilization of 5.65 hours, less, in fact, than the Britannia has achieved after only nine months. The same figures for the Douglas DC-7 at the completion of its first year in service was 6.6 hours, approximately the same as the Britannia is expected to reach by the time it, too, has had twelve months in service. This expectation seems justified by the fact that during the last two periods for which figures are available utilization has averaged nearly eight hours a day. An important point to bear in mind is that both these now well-established and highly successful American aircraft are developments of earlier types, and

Fig. 1. Aircraft utilization during first years of service with B.O.A.C.

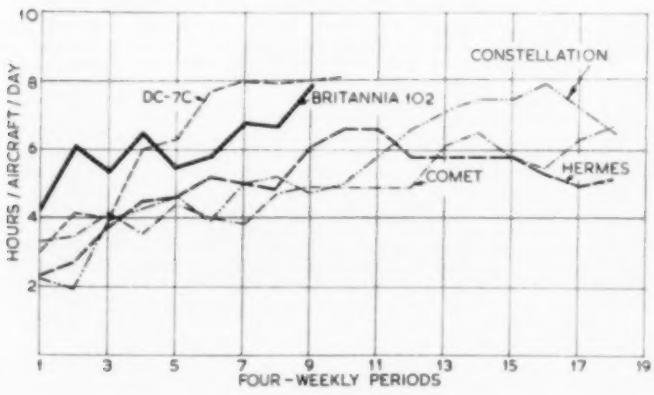
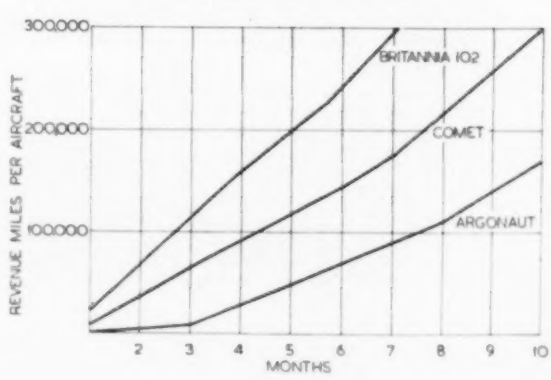


Fig. 2. Cumulative revenue miles per aircraft—comparison over first ten months of B.O.A.C. service.



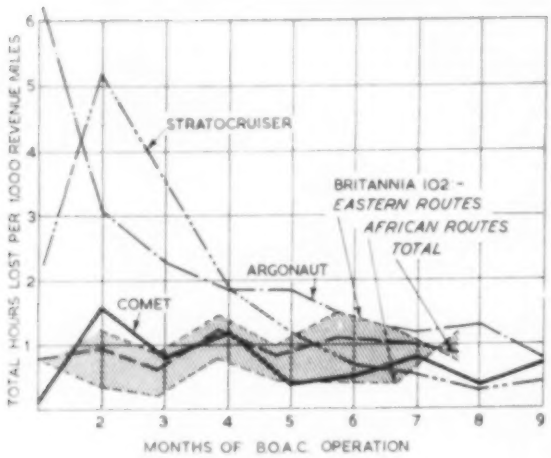


Fig. 3. Terminal punctuality (Britannia figures are total local delays at take-off and ignore flight-time gains or losses).

BRITANNIA IN SERVICE . . .

during their first year of service would, therefore, have had many of their teething troubles behind them. By contrast, the Britannia is pioneering an entirely new field of long range operation, and has achieved its remarkable results whilst operating over the longest and most exacting routes in the world.

Before proceeding with a specific analysis of upset aircraft operations due to unreliability, an explanation of associated factors is justified. Unscheduled maintenance does not invariably involve departures from timetable; the extent of delay at take-off is obviously influenced by the preceding time spent on the ground, and also upon the availability of spares.

In this respect a London - New York non-stop service is one of the most favourable operations. A stock of spares need only be held at the two terminal bases while the time between landing and take-off leaves many hours available for correcting faults without affecting schedules. At the other extreme a service in the Far East with seven or eight transit stops of 45 minutes each, suffers a far greater chance of accumulating delays, with the problem magnified if the operator is unable to make-up a shortage of spares by borrowing from another operator using the same type of equipment. Such circumstances are eased on a service that includes an en-route night stop.

Casual impressions may also vary according to the method of presentation of the statistics. A delay of one hour will not only read as a higher percentage of the elapsed time for a fast service than for a slower one, but also seem more startling if referred to a 10 hour flight rather than to a 3,000 mile flight.

Late arrival at points of destination represents a measure of inconvenience imposed upon the travelling public. As the extent and form of unscheduled maintenance is unpredictable (if known it can, of course, be scheduled), reputation largely depends upon the reliability of the aircraft and all its components. With a degree of trouble inevitable, the airline must train its engineers to diagnose and correct faults and organize a supply of spares. Over-confidence in Britannia and its ground organization, in spite of its new complexities and unfamiliarity, led to a ground turn-round time of 45 minutes being scheduled from the start of passenger services.

Unfortunately there have been many teething troubles and approximately 20 per cent of all scheduled take-offs have been delayed for engineering causes. In the first 24 weeks of operation a total of 1,574 hours were lost. Nearly three-quarters of the total can be accounted for by 26 delays of durations exceeding 12 hours. Twenty-three of these were on the Far Eastern service. These defects included seven engine changes, two engine control units, three elevator "feel" units, two brake reducing valves, two fire extinguisher bottles and 10 isolated components. A careful study has been made to estimate the actual work-time taken to replace the defective parts; this suggests that had spares been available on the spot 850 hours would have been saved.

Out of 15 different ports of call Singapore seems to be the most unfortunate; nearly 25 per cent of the total of all delays occurred there, including six which together accounted for 300 hours. Other delays exceeding 12 hours occurred at Karachi (6), Calcutta (3), Sydney (3), Darwin (2) and Khartoum (2).

A breakdown (this term is not meant to be taken too literally) of the time lost by groups of components is shown in Table 1. Dealing first with the airframe, i.e., those aircraft parts which are not periodically removed and overhauled and which in time rotate through the fleet: with a total of approximately 25,000 hours in service there are as yet insufficient hours on any one aircraft to substantiate the claim, based on various fatigue tests, of reliability with long life and fail safe characteristics. But with the exception of minor damage to control surfaces and ribs resulting in the main from accidental impacts, airframe serviceability is very promising. This is confirmed by the approved inspection frequencies, recently raised for Check I to 125 hours, Check II 325 hours, Check III 900 hours and Check IV 1,800 hours. These times are approximately 50 per cent longer than those approved for the Viscount after 12 months of operation.

With regard to component reliability, it should be explained that a component is regarded as any item on the aircraft that has an approved period between overhauls and which on removal for this purpose is replaced by a reconditioned unit. At present a considerable number of components have shown "no defect" on stripping; in such appropriate cases an increase in overhaul period is justified. When such times have been fixed, reliability can be assessed by an "index number" which is directly proportional to the number of unscheduled removals and inversely proportional to the total flying hours of all such particular components.

With a target overhaul period of 1,500 hours the "index number" is increased in the ratio 1,500 to the actual component overhaul period, i.e., the numerical value is increased if the overhaul period is less than 1,500 hours.

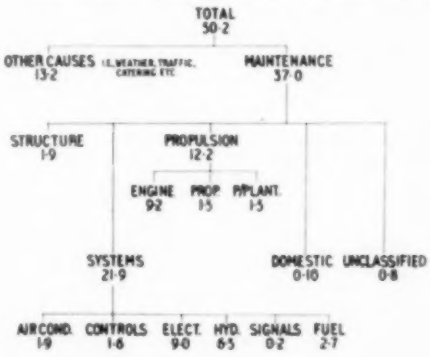
Thus the reliability index number

$$= K \times \frac{\text{No. of unscheduled removals}}{\text{No. of components} \times \text{fleet hours}} \times \frac{1{,}500}{\text{actual overhaul period}}$$

Note: $K = 1{,}000$

Various B.O.A.C. fleet engineering reports give information on unscheduled removal of components. These are not comprehensive lists, but as their purpose is to attract attention to trouble spots it is safe to assume that all significant items are included. Table 1 shows that an undue amount of time has been lost due to lack of system reliability, with electrics holding the discreditable lead. Hydraulics fall but little behind and, as this system is considerably less extensive, its standard might be regarded as even less satisfactory. Much of this trouble has been due to leaking components which need to be corrected before take-off owing to the risk of losing oil. By comparison electric circuit faults can in certain cases be isolated and their correction deferred provided that an alternative service is available in the system.

TABLE 1: MINUTES LOST PER 1,000 REVENUE MILES



Bearing in mind the extensive and comprehensive nature of Britannia systems, the general run of component reliability appears not very different from that found in the older types of aircraft. Neither should we despair at the number of high index number items which are substantially in excess of normal experience. Indeed, with several trouble spots now improved by recent modification, and with vigorous action following in all cases where faults have been identified, a little optimism is not amiss.

If it can be shown that detail component reliability is typical of other aircraft but that overall delays are by comparison excessive, then the explanation for this is likely to be the lack of availability of spares. This conclusion cross-checks the analysis mentioned previously of 26 cases of excessive delay when the accounting of time lost gave waiting time as much the greatest liability.

In considering engine reliability the generally accepted measure is based upon (a) the number of propeller featherings, (b) overhaul life and (c) unscheduled removals. Taking each of these items in turn, in the first six months of operation a propeller was feathered 17 times in 59,477 engine hours or 0.286 times per 1,000 hours. This is twice as good as the Dart in the first twelve months of operation with the Viscount and three times as good as that achieved by T.C.A. with the Wright R.3350 in the Super-Constellation. More recently there has been a further improvement, in fact the present Britannia rate is nearly twice as good as before.

(*Concluded on page 935*)

GAS TURBINE DEVELOPMENT

—*at Pyestock: Hayne Constant's Sir Henry Royce Memorial Lecture*

The lecturer.

PART 1

MR. HAYNE CONSTANT, C.B.E., M.A., F.R.Ae.S., M.I.Mech.E., F.R.S., from whose lecture abstracts are given here, has been director of the National Gas Turbine Establishment since 1948. Beginning his career as a scientific officer at R.A.E. Farnborough in 1929, he was head of the Engine Department there in 1941-44 and of the research department of Power Jets (Research and Development), Ltd., in 1944-46. In 1946, before being appointed to his present post, he was Deputy Director (Research). Further abstracts from his lecture will appear in a forthcoming issue of "Flight."

FOR the subject of the 1957 Sir Henry Royce Memorial Lecture, delivered before the Derby Branch of the Royal Aeronautical Society on November 4, Mr. Hayne Constant chose *Pyestock's Contribution to Propulsion*. "Pyestock," of course, refers to the National Gas Turbine Establishment at the estate of that name near Farnborough, and the lecturer explained that he elected to use the word in the title because, from the earliest days of gas-turbine propulsion, there had been a continuity of technical policy at Pyestock in spite of the changes of name and organization to which this research centre had been subjected.

After tracing a brief historical background, beginning with the discussions which, in 1937, led to the initial collaboration between the R.A.E. and Metropolitan Vickers, the lecturer said that Pyestock's main objective had always been that of assisting industry to develop better gas turbines.

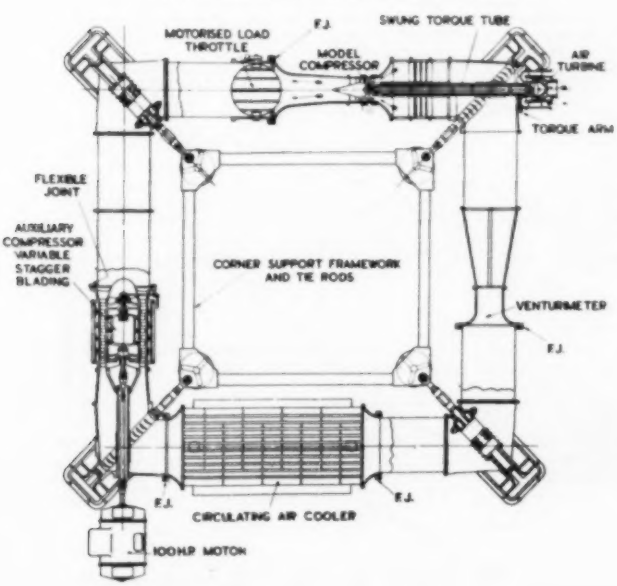
Right from the very beginning of our work there was one basic concept in our philosophy that conditioned our general thinking—the vital importance in engineering development of making a sufficiently concentrated effort on a small front to keep ahead of all competitors. In a country such as ours, in which the effort available is limited, this implies getting off the fence as quickly as possible and deciding definitely between alternative possibilities rather than giving a little backing to each.

The first example of this attitude of mind was our decision, just twenty years ago, to abandon the centrifugal compressor (of which we had quite a lot of experience) and to concentrate entirely on the unproven axial type. This judgment was based mainly on the belief that it was inherently more efficient to carry out the diffusing process in a compressor in a series of small steps at low velocity rather than in a single large supersonic jump. The advantage of reduced frontal area was then regarded as secondary and that of lightness was not appreciated until some years later.

The next occasion on which we jumped off the fence was at the outbreak of war in September 1939. Up to then we had been backing the axial type of propeller turbine as opposed to Whittle's advocacy of the centrifugal jet. We climbed down (or, rather, climbed over) and backed the jet, because we thought it an easier job than the propeller turbine and one which might be carried through in time to affect the war. It was not long before we came to the conclusion that aircraft speeds were likely to continue to rise, and that sooner or later the propeller would have to give way to the jet; and since in this country our resources were limited it would be better to take the final step right away, instead of first taking the intermediate and more difficult one of propeller propulsion. In spite of all that has happened in the intervening fifteen years I still believe that to be true. If more attention had been paid to the jet and less to the propeller we should not now be so worried about the future of our airliners (Ref. 1).

The axial engine lends itself to the annular type of combustion chamber, whereas the centrifugal engine favours the normal can type of chamber. Having plumped for the axial we naturally accepted also the corollary of using an annular chamber, and in fact specified it for, and assisted in applying it to, the Metropolitan Vickers R.A.E. F.2 engine. We appreciated right from the start the advantages of the annular chamber in giving more flow area, and a more symmetrical airflow to the turbine, but years of frustration were needed to teach us the difficulties. However, we persevered and, after many ups and downs, we now believe that the annular chamber which we have been developing over the last year or two really represents a system which not only gets over the difficulties of distortion, stability and fuel distribution which have so long been the bugbears of the annular chamber, but also represents a significant step forward in performance.

Fig. 1. The No. 114 variable-density test rig.



It was during the war (1942) that we first suggested the co-axial two-shaft compound engine as being the best method of achieving pressure ratios higher than could be attained in the simple engine. But it was not until after the war that we concluded that the double compound engine should actually be lighter than the simple engine, even at moderate pressure ratios.

We came to the conclusion in the very early days that the gas turbine lent itself to the study of problems on the component scale, and that most gas-turbine research could be done more effectively by working on components. Nearly all our efforts over the years have been directed towards the perfection of components, such as compressors and turbines, or even to sub-components, such as blade rows or even blades, and it is only recently that the problems of the complete engine have absorbed much of our attention.

From the start it was clear that the most critical component and the one most likely to hold back engine development was the compressor, and it was on this that we first concentrated our attention.

Compressors. In the early days, following the lead given by Dr. A. A. Griffith, a number of compressors had been designed relying on a combination of pure theory and divine inspiration. This seemed to work very well until we strayed into the region of compressibility, when one or other of the ingredients let us down. Fortunately we had at the same time been building up a stock of basic data on the performance of cascades of blades, and we quickly extended this to cover operation up to the speed of sound. This involved the first study to be made of compressor blades under choking conditions—a piece of work which we found fascinating and indeed exciting at the time, but which from a distance of fifteen years takes its proper place as a mere incident in the inexorable advance of knowledge. We learned quite early on the vital importance of the cascade test for providing the fundamental information on which all our compressor designs have come to be founded (Ref. 2). These measurements were actually made on three-dimensional cascades in a tunnel, but the results were corrected for end effects and could be regarded as basic data for blade rows.

After a little experience in correlating the measured performance of a limited number of compressors with the cascade data for the blade rows at mean diameter, a semi-rational theory to account for the behaviour of axial compressors was evolved. As more information gradually became available from tests on both compressors and cascades, this theory was refined and added to by a number of design rules, rules with which the name of Raymond Howell will always be associated. I think that the development of these design rules for predicting performance has been our principal contribution to the axial compressor (Ref. 3).

These rules were based on a large number of tests of different kinds carried out on a variety of machines. They involved the analysis and interpretation by means of our general theory of compressor operation of the results of several hundred compressor tests made by industry and by the Establishment.

In the course of this work detailed investigations have been made into a number of specific effects such as the nature of secondary flows, the effect of tip clearance and the influence of Reynolds Number. The work on Reynolds Number effects, which I think is of particular value, has been made possible by our possession of a special rig which we call No. 114. This is a

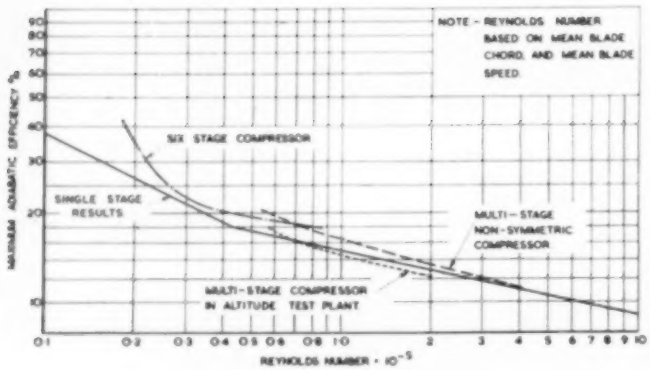

NOTE - REYNOLDS NUMBER BASED ON MEAN BLADE CHORD AND MEAN BLADE SPEED
SIX STAGE COMPRESSOR
SINGLE STAGE RESULTS
MULTI-STAGE NON-SYMMETRIC COMPRESSOR
MULTI-STAGE COMPRESSOR IN ALTITUDE TEST PLANT
MAXIMUM ADIABATIC EFFICIENCY %
REYNOLDS NUMBER - 10^{-5}

Fig. 2. Reynolds Number effects in compressors.

More recently, in 1956, the same compressor has been used to check another design point, on blade profiles. Our general practice had been to use the same profiles throughout the compressor, but we had been gradually collecting data from our cascade tests that suggested that an improvement in performance would be obtained by varying the profile. It appeared that blading with a parabolic profile with its larger throat area passed a greater airflow but with some loss in efficiency at high speed, while blading of circular arc profile gave a higher efficiency at a lower flow. We therefore rebladed the 109 compressor, which originally had parabolic blading throughout, with blades changing progressively from circular arc in the first stage to parabolic in the last. A considerable improvement in the part-load performance, with an increase in efficiency and a straightening of the surge-line "kink" resulted (Fig. 4).

Turbines. In gas-turbine research there has always been an unusual degree of co-operation and exchange of information. Individual contacts and formal organizations, such as the sub-committees of the Gas Turbine Collaboration Committee, have sometimes resulted in such close relations between different bodies working on the same problem as to give the impression that the work was being done by a single unit. The evolution of the aerodynamic design of turbines is a good example.

In the early designs of turbine the highest possible loading per stage was aimed at, the limit being set by the avoidance of recompression at the blade root. It was not until near the end of the war that it was realized that turbine efficiencies were lower than had been expected, and were mainly responsible for the poor specific fuel consumption of that time.

Immediately after the war we carried out the first tests on the turbine components of gas-turbine engines (Ref. 5) in this country, and backed them up by a comprehensive range of cascade testing (Fig. 5). As a result of this work we came to the conclusion that the principal cause of poor efficiency in contemporary turbines was their high aerodynamic loading, and we pressed for the development of multi-stage turbines (Ref. 6). By 1950 the blade loading parameter for stages without exhaust swirl, $k_p\Delta T/\frac{1}{2}U^2$, which had previously risen to over 4.0, had dropped to between 2.5 and 3.0, and substantial gains in efficiency had resulted.

The importance of a high degree of reaction had been appreciated from steam turbine experience. Others had demonstrated the gains resulting from a reduction in blade clearance and flow leakage. It remained for the Establishment to analyze the combined experience of many and produce in 1951 a systematic method for predicting overall turbine performance (Refs. 7 and 8).

(*To be continued*)

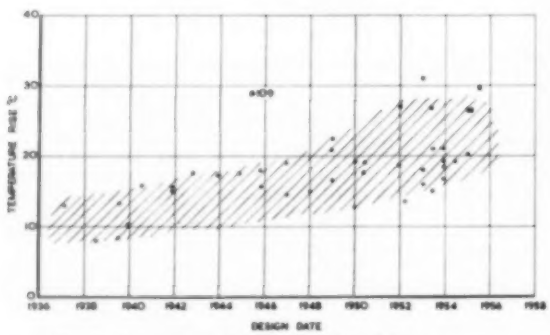


Fig. 3. Temperature rise per stage in axial compressors.

GAS TURBINE DEVELOPMENT . . .

return-circuit, variable-density wind tunnel in which tests can be made over a one-hundredfold range of Reynolds Number (Fig. 1). With this equipment it has been possible to study the effects of density both on the aerodynamic and flutter performance of axial compressor stages.

The history of the aerodynamic effects has been slightly unusual in that the answers have been obtained by successive approximations. Over the years we have obtained, or been presented with, various data alleged to represent Reynolds Number effects, with most of which we have been more or less dissatisfied. It was not until we had developed the 114 plant that we were able to get sufficiently controlled conditions and accurate results to make us believe that we had at last obtained a correct answer (Fig. 2). The flutter investigation showed that a reduction in the air density tended to move the blade away from the flutter region and therefore, in general, to reduce the vibrational stress.

Although great assistance has been given to our analytical work by testing other people's compressors, we have from time to time found a need for a more specific check on some detail point than these usually afford. Under these circumstances we usually construct and test a compressor of our own design. A good example is our number 109, which we first tested in 1946. Our general theory of compressor design had suggested that it should be possible, by maintaining a high Mach number throughout the compressor and using blade details rather unusual at that time, to reduce considerably the number of stages necessary to obtain a required pressure ratio. Accordingly, this compressor was laid out to give a pressure ratio of nearly 5:1 in six stages, about half the number normally required (Ref. 4). The compressor achieved its high designed performance and for many years remained a milestone in compressor achievement (Fig. 3).

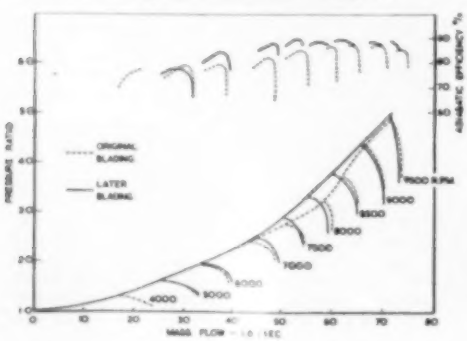
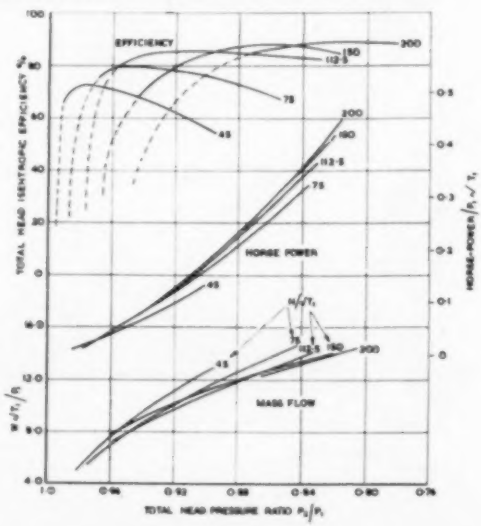


Fig. 4 (left). Performance of the No. 109 compressor.

Fig. 5 (right). Characteristics of first turbines tested immediately after the war.



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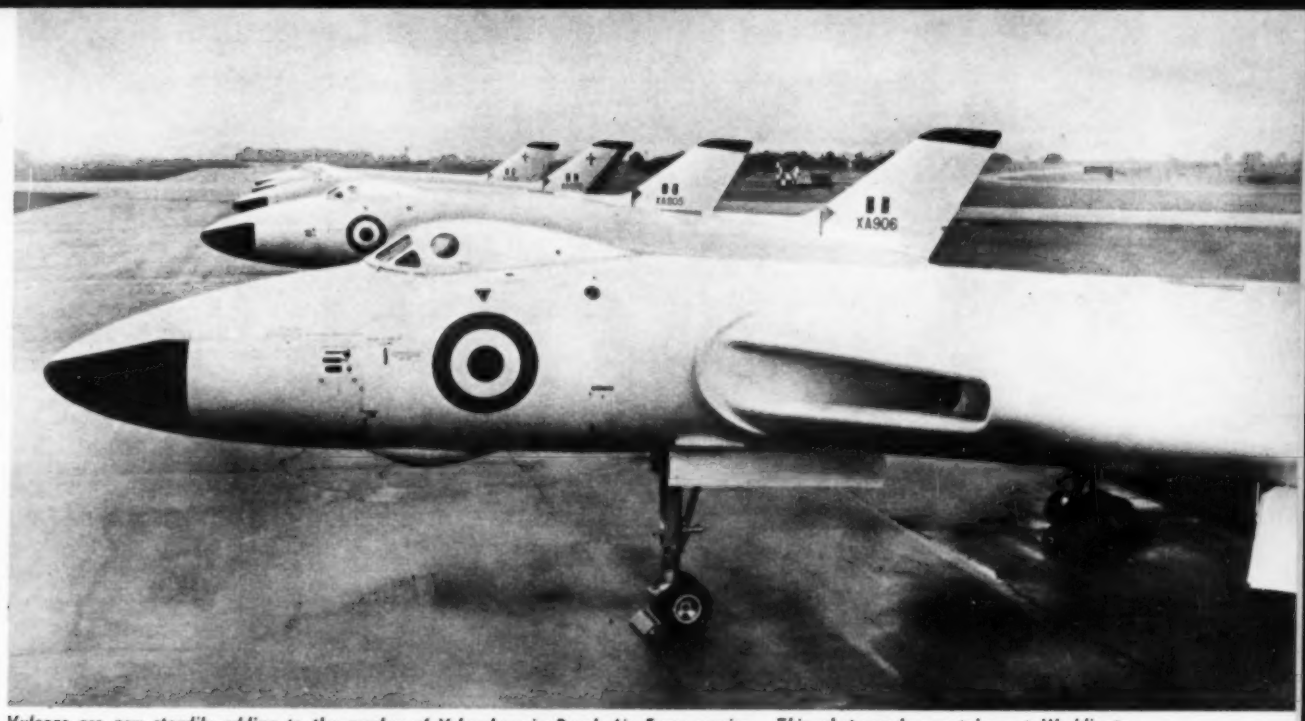
(8) A method of performance estimation for axial flow turbines: R & M 2974 (1951)—D. G. Ainley, G. C. R. Mathieson.



Vulcans are now steadily adding to the number of V-bombers in Royal Air Force service. This photograph was taken at Waddington

BUILDING THE VULCAN

—at the Avro Factories at Chadderton and Woodford

LAST week *Flight* was afforded an opportunity of visiting the production shops of A. V. Roe and Co., Ltd., to see something of the methods employed in producing the Vulcan bomber. The occasion was unique because, in recent years at least, permission has never been granted for the Press to inspect the production of an advanced military aircraft. The Vulcan certainly comes into this category, and yet we are permitted to comment on all that was shown to us—with the exception of obviously restricted items such as the geometry and dimensions of the bomb bay and the particular types of electronic gear carried on board.

As an aeroplane the Vulcan cannot require much introduction to any of our readers. A history of its development was published in *Flight* of September 27. In a nutshell, the story is: Specification, late 1946; instruction-to-proceed on the prototype, January 1948; prototype contract, March 1949; production contract, June 1952; first prototype flew, August 1952; second prototype flew, September 1953; first production Vulcan B.1 flew, January 1955; deliveries to 83 Squadron began, September 1956. The Vulcan is, of course, a large delta-wing medium bomber of the V-class, and it is powered by four Bristol Olympus turbojets.

In spite of its unusual shape and advanced performance, the Vulcan has an airframe built along remarkably traditional lines. Except for the most highly stressed parts the whole structure is manufactured from standard grades of light alloy and there is virtually no integral stiffening or machined and tapered skinning to be seen anywhere. Even brazed or bonded metal honeycombs, upon which very extensive research has been conducted at Chadderton, are confined to localized areas in the control surfaces and to access doors on the underside of the aircraft. Almost all the rest of the airframe is built up from standard sheet and sections with a small number of machined forgings, castings and extrusions.

An indication of the way in which the Vulcan is put together is afforded by the simplified cut-away drawings on page 926. Almost the entire airframe is manufactured within the Hawker Siddeley Group, and it is, in fact, quite difficult to find any portion of the structure which is not actually a product of A. V. Roe. The company maintains four principal facilities for its airframe production: the main works at Chadderton, between Manchester and Oldham; Bracebridge Heath, near Lincoln, and Langar, Notts, where, *inter alia*, airframe parts such as fins and rudders are manufactured; and the main assembly shops at the company's aerodrome at Woodford, Cheshire. In addition, sheet-metal parts are made at the Empire Works in Manchester and certain Vulcan components such as elevators and ailerons are manufactured by Armstrong Whitworth Aircraft in Coventry. As a small inset diagram on page 926 makes clear, the airframe is broken down into a number of major assemblies. These portions are connected at bolted transport joints and, in conformity with Ministry of Supply requirements, complete interchangeability has been achieved right from the start of production.

Most of the airframe starts in the detail shops at Chadderton and the small parts are then brought together in major component jigs, which are nearly all welded from standard girder sections. Among these portions are the complete centre section (the heart of the whole aeroplane and a singularly capacious component in the form of a rectangular box approximately 65ft × 28ft × 9ft 7in); the leading edges; the intakes and forward fuselage (aft of this portion there is scarcely any fuselage at all); the front fuselage, incorporating the pressure cabin; the nose, largely filled with radar-bombing equipment; and the inner trailing edge and tail end of the fuselage.

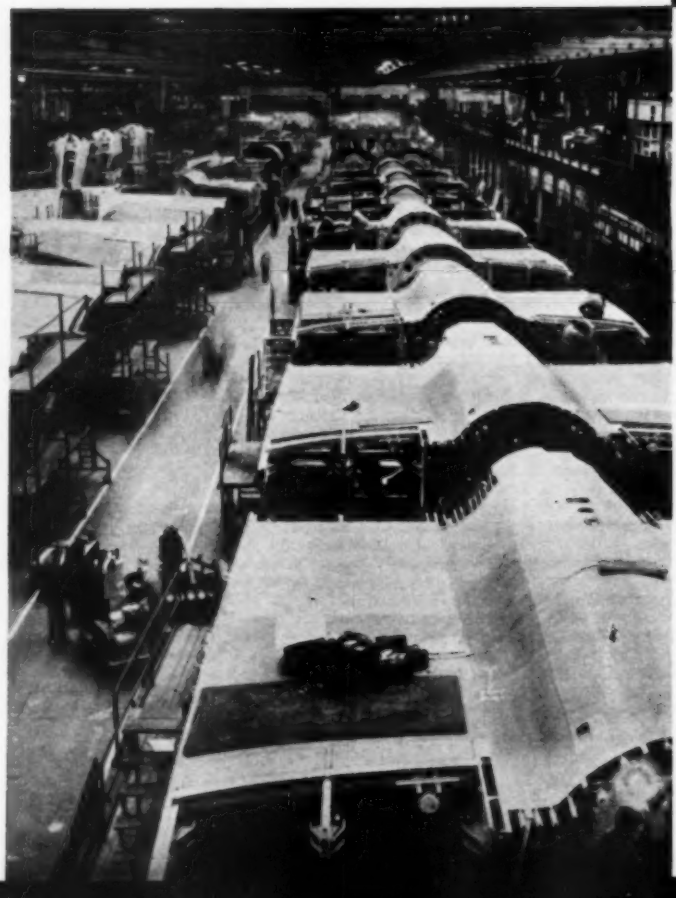
At the roots the wing has a thickness/chord ratio of the order of 12 per cent. This may seem incredible for an aircraft with almost sonic performance; but it is not a truly indicative figure, for the interior is largely occupied by engines and ducting, so that the equivalent thickness of a conventional wing would be very much less. Root chord is of the order of 58ft and the depth is in excess of 6ft for a considerable axial distance.

The wing has two principal spars, each conventionally built up from a plate web and strong upper and lower booms. Across the centre section both spars are straight and truly transverse. The front spar web has the shape of an ellipse with widely spaced foci, being made in one large sheet with continuous machined boom-members along the upper and lower edges. There are circular holes for the four engines, and the central portion forms the front face of the bomb bay and is covered with electrical circuitry, bomb-door jacks and other paraphernalia. Each powerplant is enclosed in a separate fireproof box so that the complete centre-section includes six vertical plate members arranged in the axial direction in the form of ribs. The innermost pair of these correspond roughly with the width of the fuselage, which is a secondary structure forming a relatively unstressed circular cross-section.

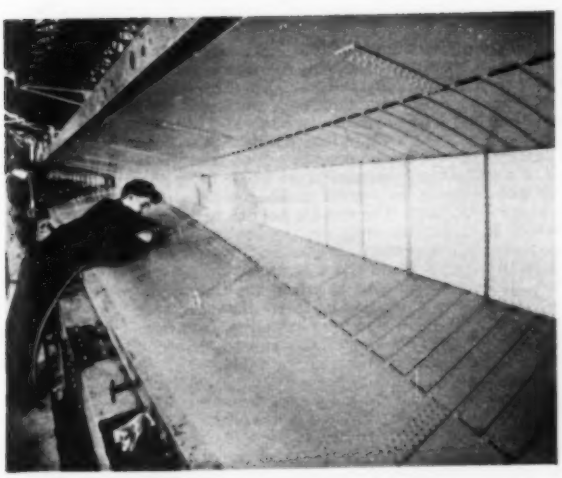
Major loads are transmitted by strong arches between the innermost axial rib-like members, and these arches also support the weight of the weapons hung beneath. During assembly this portion is mounted horizontally on spherically located supports, numerous temporary ties being inserted to join the lower edges of the innermost ribs. The circular peripheral members around the engine holes in the spar transmit the major wing bending loads, and so are machined from high-tensile steel. At the extremities of the front spar are large High Duty Alloys forgings to which the corresponding member of the outer wing is attached. The latter is swept back and the forging accordingly has a complex

(Contd. on p. 926, after double page of photographs of Vulcan production)

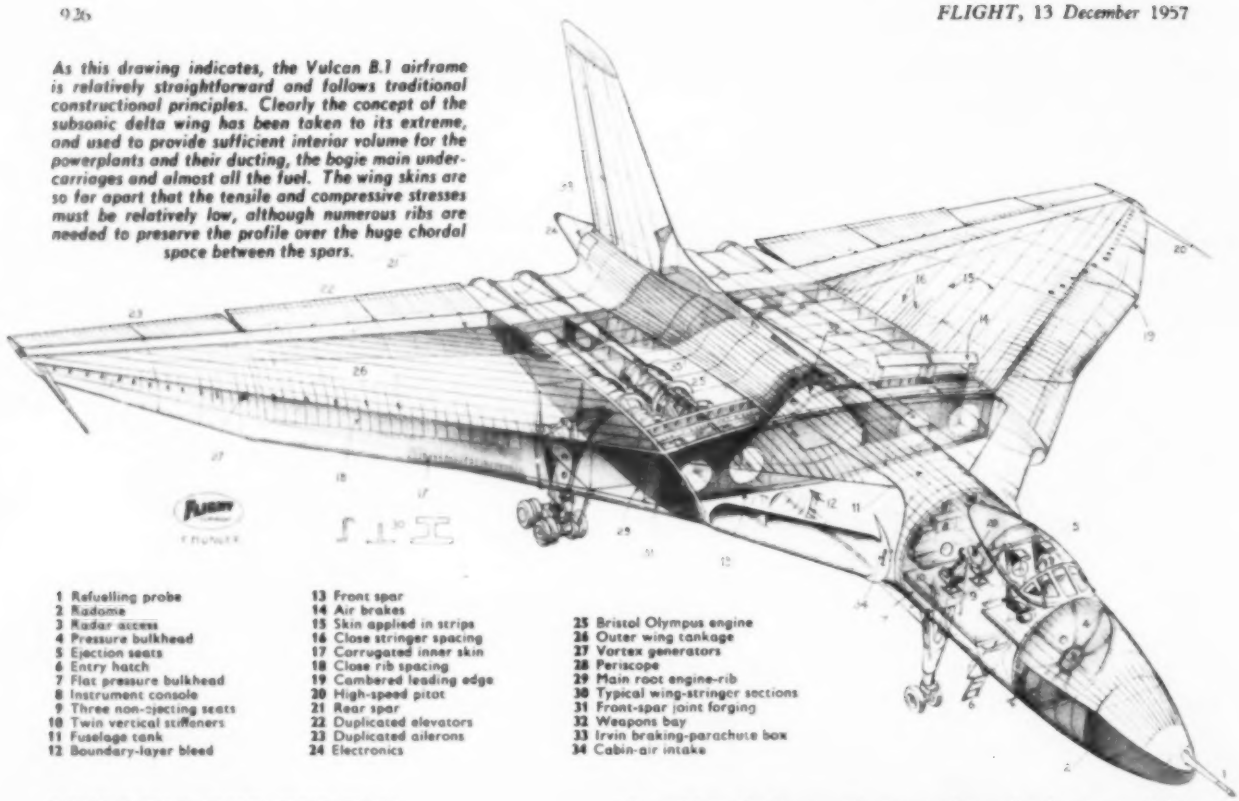
BUILDING THE VULCAN . . .



Big aircraft in a big erecting shop usually make an effective picture—always provided they are present in impressive numbers. That proviso is amply fulfilled by these views of Avro Vulcan production at Chadderton and Woodford. In the largest view the emphasis is on nose sections, while centre sections seen from contrasting angles are the subject of two of the smaller pictures at the bottom. Seen in the close-up view is an operative, inside one of the vast leading-edge assemblies, drilling doubler-plates prior to riveting. The remaining photograph, directly above, shows airframes in a near-complete stage at the final-assembly factory at Woodford.



As this drawing indicates, the Vulcan B.1 airframe is relatively straightforward and follows traditional constructional principles. Clearly the concept of the subsonic delta wing has been taken to its extreme, and used to provide sufficient interior volume for the powerplants and their ducting, the bogie main undercarriages and almost all the fuel. The wing skins are so far apart that the tensile and compressive stresses must be relatively low, although numerous ribs are needed to preserve the profile over the huge chordal space between the spars.



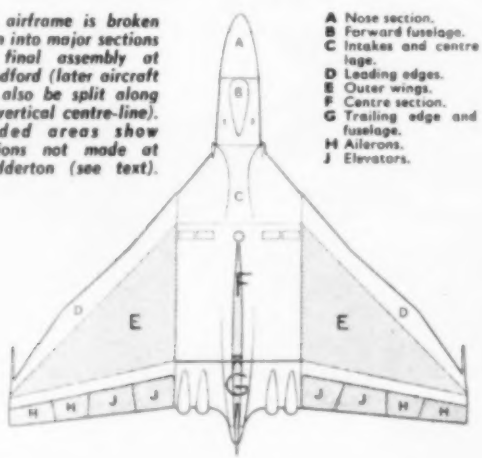
1 Refuelling probe
2 Radome
3 Radar access
4 Pressure bulkhead
5 Ejection seats
6 Entry hatch
7 Flat pressure bulkhead
8 Instrument console
9 Three non-ejecting seats
10 Twin vertical stiffeners
11 Fuselage tank
12 Boundary-layer bleed
13 Front spar
14 Air brakes
15 Skin applied in strips
16 Close stringer spacing
17 Corrugated inner skin
18 Close rib spacing
19 Cambered leading edge
20 High-speed pitot
21 Rear spar
22 Duplicated elevators
23 Duplicated ailerons
24 Electronics
25 Bristol Olympus engine
26 Outer wing tankage
27 Vortex generators
28 Periscope
29 Main root engine-rib
30 Typical wing-stringer sections
31 Front-spar joint forging
32 Weapons bay
33 Irvin braking-parachute box
34 Cabin-air intake

BUILDING THE VULCAN . . .

shape with large tongues projecting along the axes of the front spar, outer-wing spar and engine rib. The rear part of the inner wing is built up on the rear spar, which is similarly a single sheet across the centre section with strong peripheral circles around the low-slung jet pipes.

Owing to their great size and unusual form, the intakes are assembled in vertical jigs, with the port and starboard portions correctly located relative to each other so that their inboard ends appear to reach up into the roof. Staging is provided at frequent intervals enabling personnel to work on all parts of the structure. It is here that the circular-section fuselage begins to emerge, the lower part housing the nose undercarriage and the upper section being occupied by tankage. At the forward end of this portion is a transverse plate frame which forms the rear pressure bulkhead of the crew compartment. To the lower part of this bulkhead is attached the nose undercarriage (like the main gear, a product of Dowty Equipment, Ltd.) the loads from the main pivots being taken out through massive vertical beams running the full depth of the fuselage. In consequence, the rear pressure bulkhead is flat. The crew compartment itself is of circular section and is in most respects conventional, terminating at a slightly concave front pressure bulkhead with eight radial stiffeners. Forward of this point the fuselage consists solely of a cantilevered upper portion carrying the Flight Refuelling probe and from which is suspended the radar bombing gear and numerous other components. All the rest of the nose is formed from the immense Avro-manufactured radome, one of the largest glass-fibre mouldings to be put into production anywhere.

The airframe is broken down into major sections for final assembly at Woodford (later aircraft will also be split along the vertical centre-line). Shaded areas show portions not made at Chadderton (see text).



A Nose section.
B Forward fuselage.
C Intakes and centre fuselage.
D Leading edges.
E Outer wings.
F Centre section.
G Trailing edge and rear fuselage.
H Ailerons.
J Elevators.

Wing leading edges are manufactured with envelope tooling, of the type pioneered by Fairey. This gives the requisite degree of manufacturing accuracy and results in an admirably finished part, notwithstanding its irregular profile with a kinked planform and varying camber. As a photograph on page 925 indicates, a double skin is fitted inside the leading edge proper, providing chordwise passages roughly 0.125in deep for de-icing air.

This completes the work done at Chadderton. All portions of the airframe are then taken by road to the assembly plant at Woodford, some ten miles south of Manchester. Much the largest portion is the centre section and it is this which gives rise to the curious sight of numerous hinged lamp-posts on the ring road around Manchester and through Stockport. In order to ease transport problems later Vulcans will be split down the vertical centreline into port and starboard halves, but aircraft so far manufactured are continuous between the root ribs of the wings.

When the centre sections arrive at Woodford they are lifted by a travelling crane and placed on one of four large concrete jigs fixed rigidly to the floor and provided with numerous locating points to ensure that complete airframe interchangeability is maintained. These jigs hold the centre section at the correct angle and height above the floor for a considerable amount of additional manufacturing and installational work to take place. At the same time the main triangular inter-spar portion of each wing is assembled in one of a quartet of horizontal jigs. These inter-spar areas are built up principally from a great number of sheet ribs spaced as closely as one foot apart. The ribs are not notched, spanwise stringers (which have sections indicated by an inset in the cut-away drawing above) being mounted on the ribs by small angle attachments and leaving a peripheral space between the rib and the skin. Riveted angles are also used to attach the ribs to the webs of the spars. When the whole box has been put together it is skinned with strips roughly 15in wide and extending from root to tip parallel to the front spar. Each strip has several stringers, assembly being assisted by men working inside the wing.

At the appropriate stage the travelling crane picks up the centre section and places it on a large trolley which, although not mounted on rails, can roll in the direction in which the aircraft is facing. The wings are brought up on separate trolleys and located correctly on the root ribs by means of hand jack-screws. Finally the big Dowty main legs and eight-wheel bogies are hung from their pivots and the nose gear is put on, permitting the aircraft to be moved forward on its own wheels. Installation of the powerplants, control surfaces, operational gear and equipment then proceeds normally, after which the aircraft is subjected to extensive systems-testing and pre-flight checking. It is then taken out on to the airfield and flown, still wearing its green undercoat of standard

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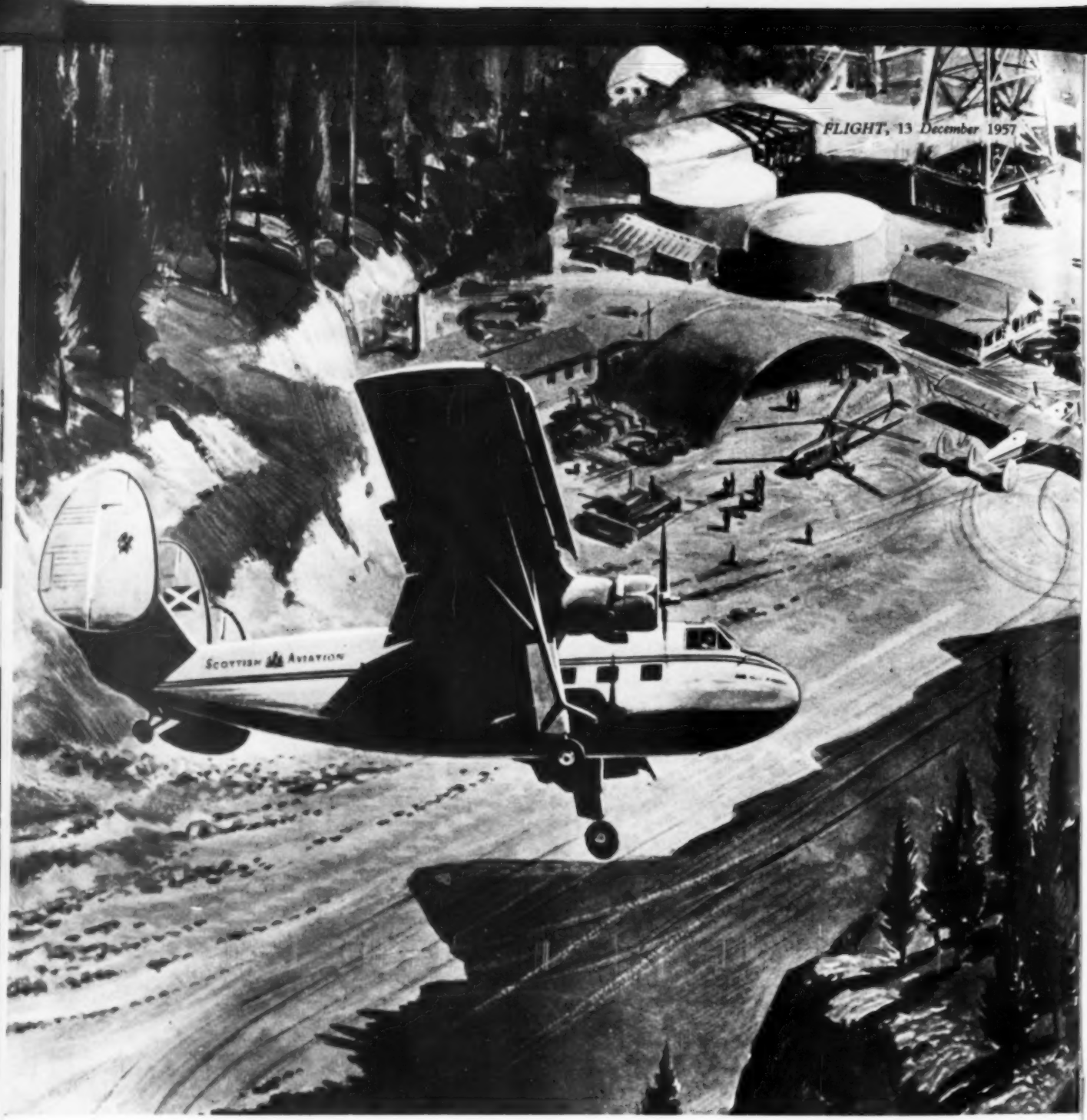

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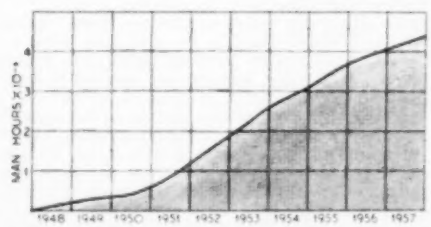
BUILDING THE VULCAN . . .

etching primer. After being flown the aircraft is brought back to the head of the assembly line and given its two coats of glossy white anti-radiation paint, and is once more subjected to thorough checks before delivery to the Service. At the time of our visit the three aircraft in this final condition were XH 475-7, each of which bore a 5ft cone at the tail end of the fuselage apparently housing some electronic device.

Before leaving Woodford we were permitted to spend some minutes seated in the cockpit of an early Vulcan B.1. Climbing up through the hatch immediately forward of the nose undercarriage one comes first to the lower deck, at the rear of which are side-by-side aft-facing seats for the signaller, radar-bomber and countermeasures operator. A further near-vertical climb allows one to grasp hand-holds behind the side-by-side ejection seats for the two pilots and so heave oneself through the narrow opening between these seats and on to the flight deck proper. Once installed, the Vulcan pilot must find everything very much to his liking. His lofty perch commands a near-perfect view in all essential directions, including directly forward over the nose where he can see the ground less than 100ft away. Even the small circular windows at the sides of the opaque canopy are exactly in the right position and command a perfect view upwards, downwards and as far aft as the seat harness will permit. In addition, periscopes are provided on either side of the canopy to permit scanning of the wings and empennage. Direct-vision panels are provided for each pilot and anti-dazzle screens hinge down from the roof.

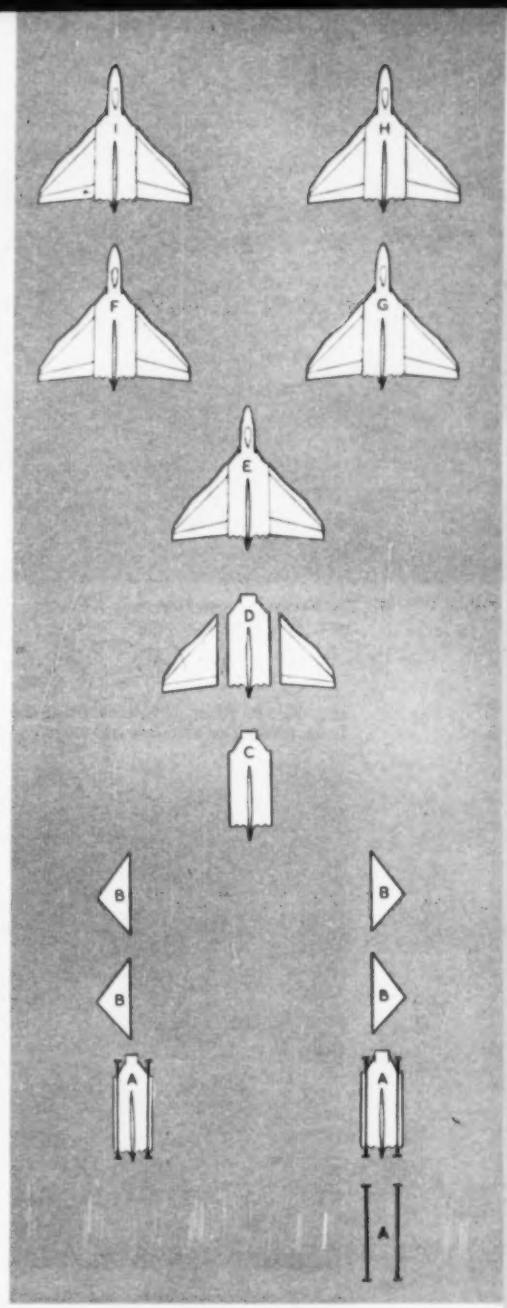


Design and engineering man-hours for the Avro 698 Vulcan. These figures may be compared with those for the Boeing B-52, published in our issue of November 15. The two aircraft are roughly contemporary.

The Vulcan is flown by a fighter-type stick. On this are mounted finger buttons for manual variation of the degree of artificial feel in the powered flying controls, the main sub-contractor for the latter being Boulton Paul. On the central instrument panel is a neat horizontal row of doll's eyes for air brakes, bomb doors, pitot heaters, powered flying controls, and artificial feel (three for each of the latter two systems, one for each axis). Immediately beneath is a single indicator which, when three horizontal lines are all aligned to a single index, denotes neutral trim for take-off. There are many other similar examples of neat instrumentation whereby the correct state can be assessed at a glance by either pilot. Farther to the left is a doll's eye for the feel box, which blinks a warning should the feel become displaced from the true speed of the aircraft by more than 30 knots.

Control of the powered flying control system is managed from a box on the port console, the circuits being engaged by groups and switched off individually should malfunction occur. On the central pedestal are the four power levers, beside which is a governing lever which can be set to "take-off" or "cruise" and thus relieves the pilot of responsibility for perpetual re-positioning. The air-brake control is at the rear of the pedestal. At the top of the main control column is a four-way trim button, and the pilot's thumb can also operate a switch for the engagement of nosewheel steering, the latter being controlled in the usual manner by the pedals. Another unfamiliar instrument which caught our eye was an indicator for fuel centre of gravity.

The diagram on the right illustrates the general disposition of partially completed Vulcan B.K. Mk 1 aircraft in the final erection bay at Woodford at the time of our visit. No attempt has been made to preserve precise scale. In an adjacent bay are Shackleton M.R.3 aircraft for Coastal Command and the South African Air Force. A photograph of the Vulcan assembly line appears on page 924.



A Three concrete jigs fixed to the floor. These accept the complete centre section, prove it for geometrical accuracy and interchangeability and hold it during further installational work.

B Four horizontal jigs for the triangular outer-wing box between the spars. The edge of the box adjacent to the front spar faces the central walkway.

C Centre section on trolley awaiting wings.

D Centre section and wings being offered up on trolleys.

E Aircraft in green primer finish, standing on its own wheels and starting functional checks for (for example) fuel, hydraulics, air-conditioning and electrics.

F Aircraft nearing completion, awaiting installation of operational equipment and undergoing pre-flight checks.

G White-painted aircraft undergoing post-flight checks.

H Completed aircraft XH 476 in final inspection.

I Completed aircraft XH 475 awaiting collection.

It is unfortunate that, owing to the great potency of aircraft like the Vulcan, the total establishment for such machines in No. 1 Group of Bomber Command is relatively small. The great Avro organization—which is so used to maintaining a large volume flow of aeroplanes—cannot be working anywhere near its true capacity, and there is certainly ample space for a big increase in output should this be required. All Vulcans are being delivered for a fixed price, and for value-for-money these aircraft must be among the best in the world. Rightly are A. V. Roe and Co. very pleased with this great aeroplane, which is behaving so splendidly in operational service.

W.T.G.

EAGLE APPOINTMENT

THE post of sales consultant and representative at Eagle Aircraft Services, Ltd.—a member of the Eagle Group at Blackbushe Airport—has been filled by A. V-M. Sir Leslie J. V. Bates, K.B.E., C.B.

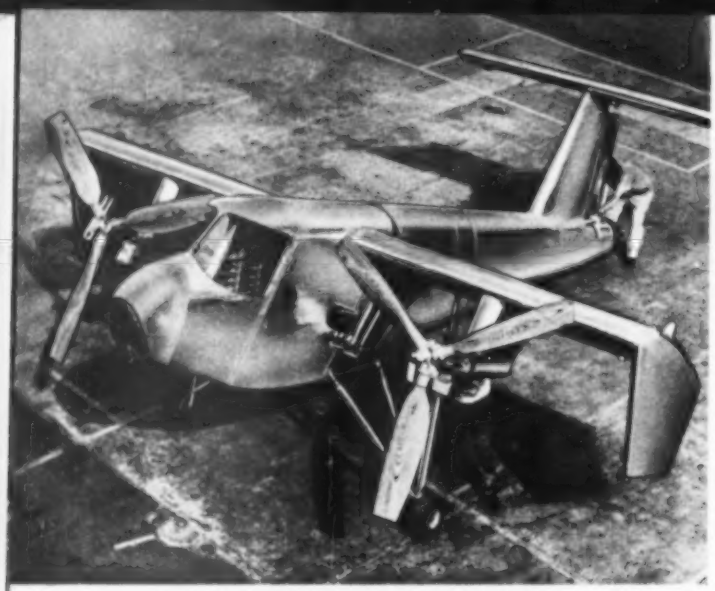
Sir Leslie's last appointment before retiring from the R.A.F. was that of Director-General of Equipment in the Air Ministry, prior to which he was A.O.C. No. 40 Group. In the war he served on the staff of Maintenance Command H.Q., was Deputy Director of Movements, Air Ministry, and saw service in North Africa as Deputy Commander of Mediterranean Air Transport Services.

G.E.C. DIRECTORSHIPS

THREE new assistant managing directors have been appointed to the Board of the General Electric Co., Ltd. They are Mr. T. W. Heather, who takes over for the general products group; Mr. A. L. G. Lindley, who will be responsible for the engineering group; and Mr. R. E. Robinson, who takes over the telecommunications group.

Two new directors are also named: Mr. D. G. W. Acworth, who will take charge of all overseas companies and export sales, and Mr. W. J. Bird, who will be in charge of home sales of the general products group.

Ryan's Turboprop-powered Vertiplane



The Vertiplane with flaps fully retracted. It is seen, as in the other views, in a nearly completed state, and should fly in a few weeks.

CONCURRENTLY with the development of their tail-sitter X-13 Vertijet, the Ryan Aeronautical Co. of San Diego, Calif., have been working on a propeller-driven VTOL aircraft, and photographs of the prototype have lately been released.

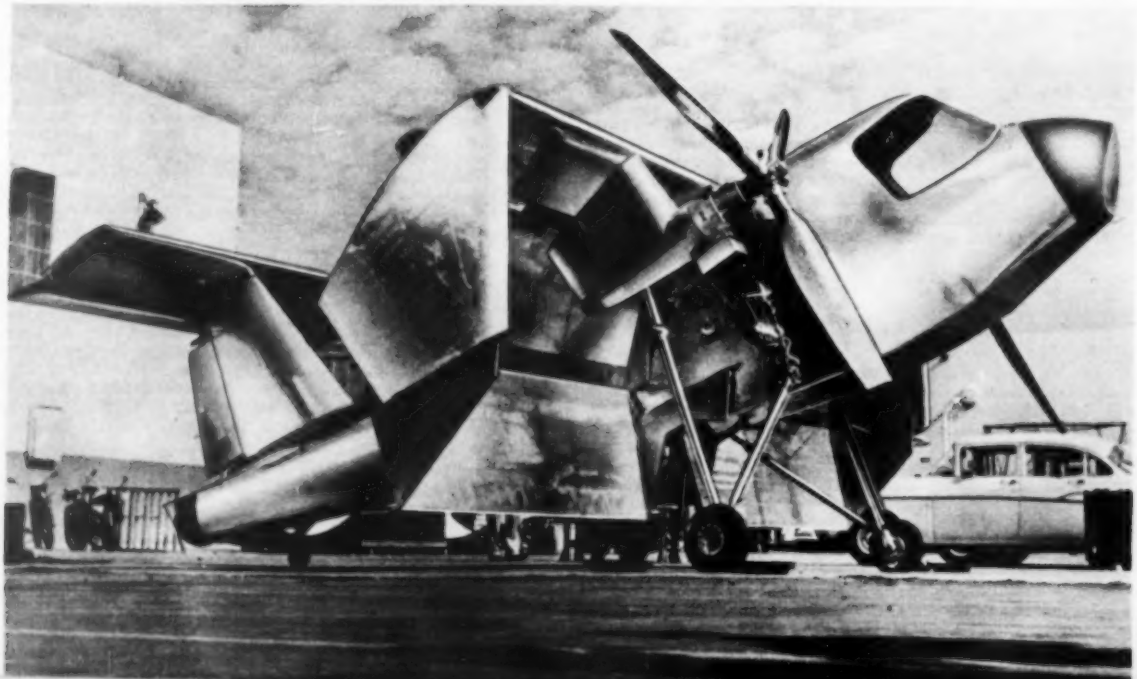
As will be seen from the reproductions on this page, vertical lift is obtained on the deflected-slipstream principle. Two large three-bladed wooden propellers, shaft-driven from a Lycoming T53 turboprop powerplant located within the fuselage, are mounted in front of, and slightly below, a high wing of low aspect-ratio. At the trailing edge, and extending over the whole of the short span, are double retractable flaps which, when fully extended, present a large downward-deflecting surface to the slipstream. Fore-and-aft surfaces depending from the wing-tips both act as flap-guides (there are also guides at the wing roots) and serve to confine the slipstream to the flap area. In addition to the conventional stick and rudder pedals for forward flight "special provisions" of an unspecified nature have been made to ensure full control in hovering flight (close examination of the photographs suggests the presence of some form of jet-deflection device at the extreme tail end of the fuselage). Transition from vertical or hovering flight is made by progressive retraction of the flaps. On landing, the pilot makes his approach with power on and some flap deflection. Then he extends the flaps fully and increases power until the desired slow rate of descent is reached, ending in a touch-down at no forward speed. Flap drag helps to accomplish a smooth landing transition at almost constant attitude.

The Vertiplane has been built by Ryan for the U.S. Army under the technical direction of the Office of Naval Research, and is visualized as performing medium-speed liaison, reconnaissance or utility duties. It should also have applications, say Ryan, for anti-submarine work or, in civil service, as an executive transport or feederliner.

All-up weight of the two-seat prototype is approximately 2,600 lb. Overall length is 27ft 8in, height 10ft 8in and span 23ft 5in. The T53 is rated at about 900 s.h.p.

Maj.-Gen. F. Yount, U.S. Army Chief of Transportation, congratulates Bruce Smith, Ryan's vice-president engineering, on the roll-out at the San Diego plant.

A stilty undercarriage provides ground clearance for the vast flaps in their fully extended position for VTOL slipstream deflection. This prototype has seating for two.



MADE FOR THE JOB

IT WAS part of nature's plan to design a long neck for the giraffe so that it might eat food hanging high above the reach of other beasts. Similar careful thought has been given to every aspect of the Skeeter, designed and built by Saunders-Roe to give the finest performance in the many roles which a light helicopter has to fill. The Skeeter is ideal for training, light liaison and A.O.P. duties and is now in production for the British Army, the Royal Air Force and the armed forces of West Germany.

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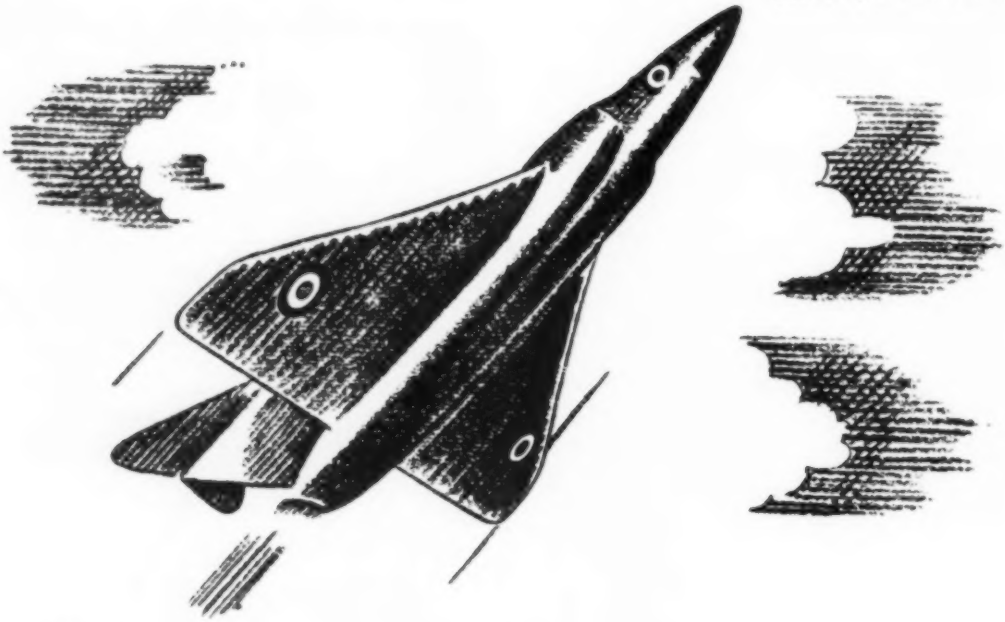

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SUPERSONIC FLIGHT TESTING

Techniques and Procedures Described by English Electric's Chief Test Pilot

The author in the cockpit of the first prototype P.1B.

"Flight" photograph

AS briefly recorded in our issue of November 29, a remarkably informative lecture was given on November 27 to the Graduates and Students Section of the Royal Aeronautical Society by W/C. R. P. Beamont, manager of flight operations and chief test pilot, English Electric Co., Ltd. Below is given a more extensive version of the lecture.

FOR many years [said W/C. Beamont] we in this country lagged behind in experience of supersonic flight. True supersonic flight began in Britain in 1954, when the P.1 prototype exceeded Mach 1 in level flight in August, and since then more than 700 flights have been made by P.1s, mostly at supersonic speed. The Fairey Deltas, which first exceeded Mach 1 in level flight in 1955, have also completed some hundreds of flights, including the establishing of their magnificent world speed record under F.A.I. rules in 1956, which remains unbroken today.

The P.1 programme—which has completely covered stability, performance, and operational fighter handling up to maximum design speed—has, together with the Fairey Delta programme, put our practical experience and knowledge of this subject on a par with that of the other leading world authorities.

Broadly, the supersonic aeroplane is just another aircraft from the test planning aspect and must be put through the same logical sequence of tests to prove firstly its flight safety and secondly its ability to achieve its design mission; so the prototype programme is made up as follows:—

Handling checks:—

(a) Systems functioning.

(b) Taxying for ground controllability, brake operation and energy absorption, ground-roll measurement, and tail-parachute functioning.

(c) First and initial flights for handling checks of functioning and response of controls, stability on all axes, trimmer ranges and effectiveness. Engine suitability and response to controls. Stall approaches and assessment of landing technique. Plus auto-observer recording of engine bay and jet-pipe-cooling suitability, electrical power supply conditions and any other critical systems items on which initial ground running has focussed attention.

In other words, it is just another aeroplane, and the tests continue within the initially set flight limitations until snags are met or until these limits are reached.

The initial flight limits are set to ensure that there is no possibility of entering into a critical "flutter" region inadvertently, but as with aircraft of this performance a relatively low indicated airspeed of 400-500 knots can still allow a high Mach number to be reached at altitude, if (as can be the case) there is no Mach flutter limit, this does not necessarily hinder early handling investigation at high Mach numbers. This was the case with the first prototype P.1A, which was handled supersonically with ease and comfort on its third flight, and also with the first P.1B, which reached M=1.2 on its first flight.

During this phase there is likely to be some preoccupation with minor systems defects in radio, warning systems, etc. By Ministry edict, these aeroplanes are now fitted with the most impressive rows of warning lights, doll's-eye indicators and flashing "attention getters." These are excellent devices, for once the pilot has learned to control his initial impulse to climb over the side on seeing the flashing reds he is presented with detailed information on which of the complex systems is malfunctioning. In the early stages, of course, it is not uncommon for a pilot to absorb the shock of the red flashes only to receive another on finding the cause to be an ominous fire warning. He then has an interesting thought process which involves deciding whether he has in fact a fire, or a faulty warning system—if the latter of course, he can get home; if the former, at which stage in the return will he find out definitely one way or the other whether it is a serious fire? On occasions this state of uncertainty can continue until the aircraft is safely on the ground, in which case the pilot will then be quickly cheered up by the design gentleman, who is almost sure to say to him during de-briefing: "Well, what are you worrying about? It wasn't actually on fire."

However, once these complex warning systems are properly developed they are comforting aids to confident operation of what are, after all, quite complex machines. But there is a case in point here which is worth consideration. In the event of many of the systems in these aircraft giving a failure warning, the only action and decision that can be taken is by the pilot; but in the event of an indicated fire warning, it is almost always possible to detect the presence of a true fire visually by the trail of smoke or fuel if this can be seen. Almost invariably it cannot be seen from the cockpit, and for this reason as much as for any other the U.S.A.F. find it necessary to maintain units of squadron strength manned by experienced pilots and equipped with the latest high-speed jet aircraft, purely for the purpose of flying "chase" on experimental aircraft on test. This practice is not followed as a definite policy in this country, and it still continues to prove difficult to obtain adequate chase facilities to cover the full range of early experimental testing on high-speed prototypes.

That airborne observation of early prototype test flying is essential is borne out by almost every new aircraft that flies. In the case of the P.1A, undercarriage sequencing trouble was traced by this method, and a different type of undercarriage trouble experienced on the P.1B was also filmed from another aircraft and the cause traced down from this evidence. In this country, however, we normally have to experience trouble first before we can obtain a chase aircraft to observe a subsequent flight for the purpose of reproducing the defect. This is wasteful, and also fails to cover the most important aspect of chase flying, namely, that of providing the test pilot with immediate confirmatory advice when things go wrong in the first instance.

It is obviously not possible to obtain chase aircraft with adequate performance to cover all aspects of new type testing, but the American principle of employing the fastest aeroplane available in a proved and reliable state for the job is, I am sure, the right one.

Once the initial handling is complete, and a satisfactory standard of reliability has been obtained in all the aircraft services, and the standards of control response and stability have reached an adequate stage, attention is turned to raising the flutter limits in order to push out the proved performance envelope to the design limits under all conditions.

Until recent years it was normal practice to increase indicated speed gradually and to excite structural oscillation by stick-jerking or flying through turbulent air in order to attempt to excite and detect the early stages of flutter. Many incidents have occurred in which unpleasant flutter conditions have been experienced and, of course, in not a few cases loss of the aircraft has resulted. Various means are now employed of exciting structures, in known areas of possible trouble, by various mechanical means. The method employed for flutter clearance of the P.1 series has been by the R.A.E.-developed "bonking" method. By this means small explosive charges are fired, generally at 90 deg to the surface of the structure concerned, and impart a jolt to that structure. The damping of the resulting oscillation is then measured by recording equipment, and subsequent study can determine if the order of damping corresponds to the calculated value.

Theoretically this method should give a margin of safeguard against inadvertent experience of flight flutter, but although it has contributed very considerably to the rate of progress at which flutter testing has been completed on the P.1s and to the store of knowledge now available on the subject, it did not in our case prevent running into fin-rudder flutter precisely between one scheduled stage of the investigation and the next. This particular flutter condition was corrected by altering the fin stiffness, and as an added safeguard fitting as standard a viscous damper to the rudder. These methods have been most satisfactory and complete flutter clearance has been obtained throughout the, even by modern standards, impressively high design limits of the aircraft.

While flutter-clearance work is progressing, every opportunity is taken to fill in every moment of each flight not associated with the actual flutter test point with the other essential investigations, such as engine handling and suitability, single-engine handling,

Grooming the first P.1B at Warton, where the mesh guard for the air intake to the twin Rolls-Royce Avons is now a familiar sight.

"Flight" photograph

SUPERSONIC FLIGHT TESTING . . .

cockpit conditioning, radio performance and polar diagrams, and all the other items which go to making up the final 100 per cent operational aircraft which is the ultimate aim of all testing.

It is during these early flutter tests, and also the early handling for stability and control response at supersonic speed, that one of the major problems experienced at the present time in conducting these tests starts to be encountered—namely, the relatively large distances covered in short spaces of time while conducting controlled test points, and the difficulty of navigating with available airborne and ground aids under these conditions. This, coupled with the regulations limiting supersonic flying and the creeping growth of Airways and Control Zones in which test flying is not permitted, have become perhaps the most difficult factor in conducting the tests of these aircraft.

Until the late 1940s the question of controlled flight areas hardly affected the planning of flight tests, and the main considerations left to the pilot were those of weather and flight safety with regard to the particular tests envisaged.

Nowadays, the actual scheduling of a test flight may frequently have to be altered, because, although the weather is suitable at base and overhead for a certain type of test, it is unsuitable outside the Airways or Control Zone area; and as permission cannot be obtained to fly in the zone a sortie cannot take place. Further, under normal supersonic performance or stability testing conditions, the aircraft is covering the ground at anything from 20 to 25 miles per minute, and sometimes more in the event of jet streams. This results in very rapid covering of the airspace between the Control Zones, and also when these tests are being carried out at lower altitudes necessitating flight over the sea, one "runs out" of the available sea areas very quickly. The same difficulty is experienced when carrying out accelerated manœuvrability tests at high supersonic speeds, when a Rate 1 turn may encompass as much as a whole county the size of Lancashire within a few minutes. It is clearly very difficult to position tests of this nature without encroaching somewhere into a Control Zone or Airways network.

Another vital consideration on each high-performance test sortie is the overall direction of the climb-out and test run, and the final position of the aircraft at completion of the test relative to the base airfield; the reason for this is that in all tests where continuous use of reheat is necessary the fuel consumption rate is very high and the total endurance of the aircraft is reduced considerably. The range is not reduced proportionately, as at 20 miles per minute large distances are covered very quickly. It thus becomes all too easy—especially in the cases of early prototypes with limited fuel—to arrive at the end of the scheduled test run at a range for which there is insufficient fuel remaining to get back to base. Therefore, each maximum-performance sortie, or sortie in which uneconomical use of fuel is necessary, has to be planned precisely in relation to this problem, to positioning relative to the restricted flight areas, and thirdly to the need for restricting shock-wave incidents to sea areas. With this degree of complication it is not surprising that things go wrong at times, such as sorties becoming abortive due to inaccurate positioning, or shock-wave incidents being reported from coastal areas.

One of the causes of these difficulties is lack of precise navigational information. Owing to heavy traffic on the V.H.F. fixing networks, the average time-delay in obtaining a fix from these services is of the order of two minutes; and as the aircraft cover up to 50 miles in that period, the information is of little value by the time it is available. The same thing applies to all other forms of navigational aid available for the purpose of this particular programme; and although with the equipment specified for the operational P.1, together with full R.A.F. radar monitoring, the difficulties will be overcome, these facilities have not so far been available for the test programme. In view of the ever-present problem of the overloading of radar networks it may be that a secondary type of A.C.R., in conjunction with transponders in the aircraft giving individual identification signals, might solve this problem.

So, having cleared the early systems unserviceabilities, flutter limitations and any other limiting circumstances such as control of reheat, etc., the stage was set for getting down to the measurement of stability and control, and performance up to design Mach number.

Experiences in America with some of the Century series fighters focussed attention on the characteristic reduction in the directional stability derivative N_v which can occur from about M=1.4 (and especially as this happened with fatal results on the F-100) and so this aspect was very thoroughly examined with the P.1 prototypes.

Speed was increased in separate flights by increments of M=0.05 from M=1.2, and under stabilized conditions a rudder displacement of 150 lb force was applied. The rudder was then released and the resulting oscillation allowed to damp stick and rudder free, with trace recordings of decay rate, accelerations and three-axes displacements.

Visual observation by the pilot of the damping rate at each stage also served as comforting confirmation to the pilot that N_v was remaining positive and that all was well. It said much for the aircraft that it could be trimmed hands- and feet-off at these tremendous speeds, and that the pilot could become confident in applying uncomfortably large angles of sideslip and then sitting back and watching the aeroplane sort itself out. Even so, the moments leading up to the first occasion when this had to be done at a speed in excess of the current world speed record will remain memorable to the pilot. But, of course, there was no need to worry, and the aircraft remained as docile and well behaved as at the lower speeds, N_v proving to be precisely as calculated in the design phase some years previously.

While all this was going on, care had to be taken on other counts. We were approaching the region where intake buzz might occur with unpredictable abruptness and effect, and so it was necessary that speed control should not involve sharp changes in engine speed at this stage prior to a full investigation of this problem as a separate programme.

In the event, the P.1B took this investigation in its stride, the ease and lack of fuss with which it is flown and manœuvred at design speed is really impressive, as is the rate of longitudinal acceleration remaining at this point.

I have made little mention of flying controls, for the very good reason that they have required little attention. This is a bonus which results from the elimination of the trial-and-error development methods essential with even the best designs of aerodynamically balanced controls. With the Hobson powered control system giving remarkably little trouble, the establishing of well harmonized controls has been a case of minor modification to spring rates or gearing; and the full duplication of the control systems from separate engine power sources, which has eliminated the need for manual reversion on the critical controls, has further simplified flight development.

Neither has any detailed mention been necessary of transonic stability problems, as with the all-flying tailplane low-mounted on the rear fuselage these have been virtually non-existent. There is no pitch-up of the type experienced with so many transonic and supersonic designs, and transition is barely detectable by the pilot in 1g flight conditions. A more clear trim change is experienced when carrying out the transition under g, but this does not exceed a total increment of $\frac{1}{2}$g.

At supersonic speeds, longitudinal static stability remains almost unaffected within the pilot's threshold; and, in fact, the only clear indication of change experienced by the pilot at above Mach 1 is that he can reach his g limits without achieving a buffet threshold. So flight at supersonic speeds under all conditions remains entirely smooth and buffet free.

To summarize, then, the P.1 flight development programme has left the pilot with three main impressions:—

(1) Satisfaction in an unusually well-harmonized "pilot's aeroplane" at all speeds.

(2) Frustration in the continued difficulties experienced in navigating without adequate navigational facilities.

(3) Embarrassment over inability to carry out tests at the speeds required without causing shock-wave incidents.

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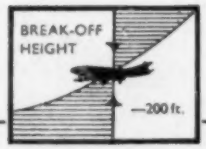

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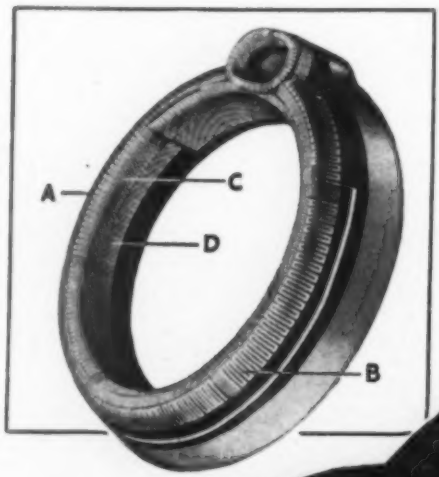

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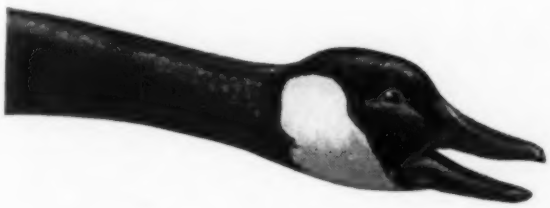
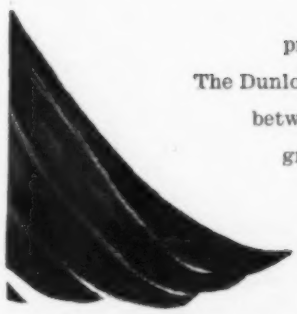


. . . north wind doth blow

LEAVING the warmer coasts of Florida the Canada goose flies high to its Arctic nesting grounds, impervious to changing temperatures. Fortunately, it is equipped not only with feathers, which provide admirable insulation, but a natural heating system. Aircraft are not so versatile in this respect. But those responsible for design and production can always call upon Dunlop for proven assistance with de-icing problems. The Dunlop electro-thermal method of de-icing, based on electrical heater circuits sandwiched between layers of rubber, allows effective surface heating which can be varied to give the greatest protection at vulnerable points. It has made a highly successful contribution to safety and operational efficiency in conditions which cause icing-up. For full details write to the address below.



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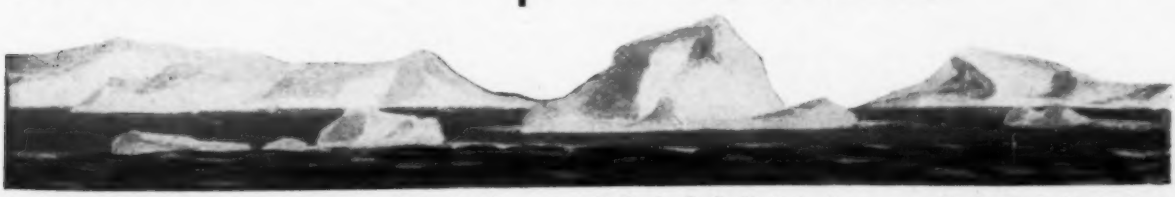

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Praise from all quarters

Admiration FROM AUSTRALIA

Butler Air Transport Ltd., NSW, have been operating Viscount 747s for nearly two years. Mr. A. Butler recently expressed 'his appreciation and admiration of these wonderful aircraft which have brought a standard of travel equal to the world's best, to the outback people we serve'.

Growth IN THE MIDDLE EAST

Middle East Airlines report that 'The operation of Viscounts has enabled M.E.A. to achieve two aims — to build up our regional Middle East Services and to develop from a regional into an intercontinental carrier'. Up to 78% increases in passengers carried were recorded as a result of Viscount introduction, and aircraft utilisations of from 7 to 9½ hours a day were achieved throughout the summer with no serious maintenance problems.

Praise FROM MANILA

'The Vickers Viscount is far ahead of anything I have experienced before' commented an American passenger to Philippine Air Lines. In June, on the Manila Hong-Kong route, the Viscount payload was 89.6% for the outward journey and 89.3% on the return flight.

Satisfaction IN FRANCE

From Air France comes a report of 19% traffic increase during 1956 on the London-Paris route and a 29% increase on the Swiss routes, both served by Viscounts. Particular mention is made of Air France's satisfaction with its share of total traffic on the Viscount-operated Italian and British services.

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CIVIL AVIATION

The Independents' Report

LAST week "Flight" reviewed the independent section of Britain's air transport industry. Summarized here is the British Independent Air Transport Association's report for 1956-1957, published on Monday last, December 9. Keynote of the report, as anticipated, is that Britain's private enterprise airlines are not keeping pace with the general upward trend of the business.

IN his foreword to the B.I.A.T.A. annual report for 1956-1957, the chairman, Mr. G. H. Freeman, notes that the total independent capacity produced showed a decrease on the previous year. Though certain categories of operation enjoyed varying degrees of expansion, "the total effort of the independent airlines has not kept pace with the general world-wide upward trend."

This indicated, the chairman observed, that in all but a few cases "the limits of current government policy have been reached." The independents wished the Corporations well, but "it should be obvious that their efforts alone cannot produce the full answer [to the fact that British air transport as a whole is not achieving a satisfactory position in the world]: the independent airlines, which today represent one-third of the total industry, must be allowed to play greater part."

A lead must be given, said the chairman, and that lead must come from the Government. Outmoded legislation policies must not be permitted to work "contrary to the overall interest of British air transport."

The report itself is a short one. Extracts from the main statistics, which bring up-to-date those published in *Flight* last week, are reproduced below. Dealing first with scheduled services, the report notes that the decrease in capacity represents the effect of the withdrawal of Airwork's transatlantic freight service in 1955, a decrease which has not yet been made good.

The principal gains reported during the year were in the number of passengers carried, and the passenger-miles performed, on scheduled services. The report shows that independent passenger traffic represents about 20 per cent of the British total, though in terms of passenger-miles the effort represents only seven per cent of the British total. The following table tells the passenger story over the years (results as at March 31 each year).

	1952/53	1953/54	1954/55	1955/56	1956/57
Channel Islands	23,000	49,000	69,000	98,000	153,000
Isle of Man ...	31,000	42,000	54,000	67,000	81,000
Other Internal	14,000	9,000	25,000	54,000	64,000
International ...	7,000	43,000	65,000	92,000	178,000
Vehicle Ferries	51,000	95,000	112,000	182,000	156,000
Colonial Coach	N/A	5,000	10,000	13,000	15,000
Inclusive Tours	N/A	8,000	23,000	46,000	96,000
Totals	126,000	251,000	358,000	552,000	743,000

Commenting on B.E.A.'s criticism of the economics of scheduled services from U.K. provinces to the Continent,* the report says: "Such an approach is quite contrary to the Association's view, and it is submitted that, if airlines are prepared to provide such services, it is in the interests of the travelling public that they should do so." B.I.A.T.A. could not accept that the public should be deprived of direct (and therefore cheaper and more convenient) travel "because this is not in accord with programmes and policies laid down by B.E.A."

The report welcomed the Minister's decision to permit the use of more modern aircraft on Colonial coach services, but notes with concern that it is "apparently not intended that independent airlines should be allowed any significant participation in the expansion which will result in the world-wide introduction of coach-class T.34 services." The independents had shown the validity of their argument that the real need of the industry was a broader market, resulting from cheaper fares and coach-class services. But they were not to be permitted to put their experience and resources into the expansion of this market.

Inclusive-tours carried 108,000 holidaymakers, double last year's number. But independent applications to operate I.T.s were still strongly opposed by B.E.A. ("with more success than is merited") despite the "now obvious fact" that the services nearly all operate at weekends when B.E.A. cannot itself meet the public demand. "These gains by British carriers will no doubt be welcomed at a time when the total British share of traffic in other directions is static." [*sic*]

All-freight services had been handicapped through lack of freedom to carry—inbound and outbound—whatever class of traffic was available. Domestic services were still composed mainly of non-trunk routes, and "until participation in trunk-route development is possible," would present a major economic problem. Vehicle ferry services had decreased, partly due to the unsettled international position early in 1957, and, in particular, petrol rationing.

Reviewing non-scheduled activities, the report notes a slight decrease in the capacity offered by charter and contract operations, although load ton-miles remained at the same level. Because they lacked suitable equipment, the independents were considerably handicapped in meeting foreign competition in this field. Air trooping, while still continuing to be the independents' predominant operation, did not increase in terms of passenger-miles. Due largely to the withdrawal from the Suez Canal Zone, the number of troops and families carried fell by about 50,000. Trooping contracts continued to be for short, and therefore commercially unsound, periods.

"It is the Association's view," continues the report, "that a great deal more can be done to promote air freighting for Services and Government departments to the benefit of Government economy and efficiency, and to the general development of air freighting."

In a section headed "Relations with Other Bodies," the report appreciates liaison "on the best possible basis" with various M.T.C.A. departments, and acknowledges the "help, courtesy and consideration" of the Air Transport Advisory Council. "Close working relationships" existed between B.I.A.T.A. and the two Corporations, in the interests of all parties. B.I.A.T.A. have continued to give full support to the International Federation of Independent Air Transport, and would continue to work for air transport progress along commercial lines, and not "under a system of artificially-created imitations." Of relations with the National Joint Council for Civil Transport, the report notes that the Employers' Side had done much to keep the machinery functioning "in a number of difficult circumstances."

In its concluding review of the aircraft operated and ordered by the independents, the report includes the first published reference to an order from Scottish Airlines for three Twin Pioneers.

* *In their 1956-1957 annual report, B.E.A. said: "We are convinced that the sound economic progress of short-haul European Services can only be founded upon the development of a network of heavy traffic routes."*

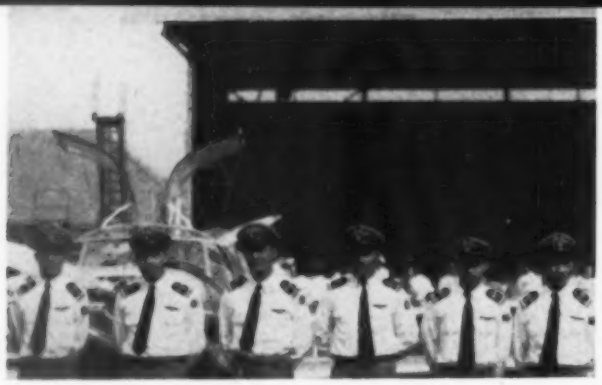
B.I.A.T.A. SCHEDULED OPERATIONS

Item	1954-55	Per cent change	1955-56	Per cent change	1956-57	Per cent change
Capacity ton miles ...	22,327,000	+ 57	36,710,000	+ 73	35,238,000	— 5
Load ton-miles	12,897,000	+ 53	21,665,000	+ 70	21,934,000	+ 2
Overall Load Factor ...	57.8%		57.1%		62.2%	
Passengers carried ...	376,489	+ 40	565,219	+ 50	690,859	+ 22
Passenger-miles	95,180,000	+ 48	127,900,000	+ 34	163,231,000	+ 27
Freight (short tons) ...	59,185	+ 45	85,069	+ 43	68,972	— 18
Freight ton-miles ...	4,082,000	+ 66	10,100,000	+149	6,944,000	— 33
Mail (short tons) ...	54	+ 41	42	— 12	70	+ 70
Mail ton-miles	48,000	+108	39,000	— 18	51,000	+ 30
Aircraft miles	7,184,000	+ 35	11,250,000	+ 56	11,739,000	+ 4
Inclusive Tours						
Capacity ton-miles ...	1,931,000	+122	3,254,000	+ 79	7,469,000	+110
Passengers ...	27,581	+126	51,863	+ 87	108,434	+108
Passenger-miles	18,188,000	+120	30,581,000	+ 68	67,021,000	+111

Note: Traffic results are as at June 30 each year.

B.I.A.T.A. NON-SCHEDULED OPERATIONS

Item	1954-5	Per cent change	1955-56	Per cent change	1956-57	Per cent change
Capacity ton-miles available ...	100,275,000	+39	117,922,000	+ 17	111,656,000	— 5
Load ton-miles performed	65,510,000	+32	89,132,000	+ 35	89,024,000	—
Passengers carried:—						
Civil ...	66,043	—11	258,713	+291	322,538	+24
Military ...	214,594	+44	204,700	— 4	157,035	—22
Total	280,637	+25	463,413	+ 65	479,573	+ 4
Passenger-miles:—						
Civil ...	90,509,000	+13	126,690,000	+ 39	144,044,000	+13
Military ...	386,547,000	+19	522,903,000	+ 34	516,302,000	—
Total	478,055,000	+22	649,593,000	+ 35	660,346,000	+ 2
Freight (short tons) ...	35,095	+ 3	44,194	+ 26	54,895	+24
Freight ton-miles ...	19,951,000	+43	29,981,000	+ 50	29,980,000	—
Aircraft miles	19,344,000	+30	20,138,000	+ 4	19,183,000	— 5



Left, graduates of the Indonesian Aviation Academy, and, right, air traffic control instruction at Djakarta.

By
CAPT. A. J. CHAVES

CIVIL AVIATION . . .

Helping Indonesia

CANCELLATION of K.L.M.'s traffic rights in Indonesia by the Government of that unhappy country (see next page) makes topical this review of the international help which Indonesian civil aviation is now receiving. The work of an I.C.A.O. mission—typical of many which are at work in undeveloped countries—is described by Capt. A. J. Chaves, chief of pilot training at the Indonesian Aviation Academy.

THE establishment of an I.C.A.O. mission in Indonesia stemmed from a general agreement between U.N.O. and the Government of Indonesia in November 1950 by which the former agreed to provide the new republic with technical assistance in various fields requiring development—aviation being one of those specified. Subsequently, under supplementary agreements negotiated directly between I.C.A.O. and the Indonesian Government, expert facilities were established in July 1951 in the following spheres: air traffic services, radio operations, radio maintenance, airports, maps and charts, and aviation economy. In addition, ten fellowships were awarded to Indonesian nationals for training in aeronautical engineering, airport construction and radio engineering. The first team of eight experts—coming from such diverse countries as America, England, Scandinavia, India and Australia—were led by a C.A.A. expert from the U.S.A., Mr. Lake Littlejohn. He was succeeded in 1952 by Mr. E. L. T. Barton, a communications specialist from the U.K. Ministry of Transport and Civil Aviation.

Until then the training of airline personnel had been handled in a limited way by K.L.M., who are responsible (under a contract extending to 1960) for the technical direction of Garuda Indonesian Airways, the national airline. I.C.A.O. had also recommended that Indonesian pilots should undergo instruction at Air Service Training and 25 were already taking courses there.

The rapid growth of aviation in Indonesia, however, outpaced its supply of trained crews. Encouraged by the success with which the mission had functioned in various other fields, the Government considered the establishment of a national aviation college to accelerate the training of air and ground crews for G.I.A. From a long-range point of view the college was also conceived as a national asset in an area almost completely without facilities for aviation training. When approached, I.C.A.O. was very glad to be associated with this scheme, which was inaugurated at the end of 1952 and resulted in the institution of the Akademi Penerbangan Indonesia (Indonesian Aviation Academy). The location selected was a disused airstrip built during the Japanese occupation and situated 25 miles south-west of Djakarta near a small village called Tjurug. A principal training adviser—Mr. M. F. Vandiver, ex-chief pilot training adviser in S.A.S. and with wide and varied experience of world-wide roving commissions on behalf of I.C.A.O.—was appointed to set up and operate the academy. Fourteen expert personnel representing an international cross-section of aviation were recruited by I.C.A.O. to assist in the enterprise, which was placed under the administration of an Indonesian director.

Because of limited equipment and facilities in the early stages, the training of airport managers, radio operators and air traffic controllers was undertaken first, followed by pilot and ground crew training with the arrival of six D.H. Chipmunks and maintenance equipment.

In the middle of 1953, Mr. Vandiver took over from Mr. Barton and continued to combine the functions of mission chief and principal training adviser till April 1957. He has been replaced by Mr. W. J. V. Branch, Chief of the PEL section in I.C.A.O., Montreal.

Because of certain technical difficulties, flight instructors were hired directly by the Indonesian Government, though their recruitment was arranged by I.C.A.O.—to whom they were technically responsible. The original Canadian team of elementary flying instructors was replaced in 1953 on the extension of the scope of training to include advanced airline work. Pilot training—both ground and flight—was reorganized under a chief of pilot training who has had experience of operations and training in Air India and the Indian Department of Civil Aviation. He was assisted by instructors from Indonesia (ex-Air Force) and from India, Australia and the U.K.

In the five years during which the I.C.A.O. mission has been operating in Indonesia, it has set up and manned 34 airports with Academy-trained personnel; organized under difficult circumstances a reasonably reliable and efficient communications and radio facilities network; and produced a total of 243 trained aviation personnel—30 airport managers, 31 air traffic controllers, 37 commercial pilots, 28 aircraft and engine mechanics and ground engineers, 48 radio maintenance personnel and 69 radio operators.

The Aviation Academy at Tjurug is developing rapidly into an A.S.T. of the East. At present a further 300 personnel are under training and expect to graduate in time to take over to a large extent when K.L.M.'s technical aid to the airline expires in April 1960. The latest equipment—with classrooms, hangars and workshops, and a fully equipped aerodrome with two runways and its own radio D/F beacon—is converting this once remote village into a modern township which may in time be a centre for the training of aviation personnel from the neighbouring countries.

Very comprehensive syllabi and the latest methods of teaching and training, approved by I.C.A.O., are being utilized to produce graduates capable of handling effectively the most modern equipment.

A large part of the air traffic control and radio maintenance training is carried out "on the job" at Kemajoran, Indonesia's largest international airport. A. & E. maintenance trainees also acquire valuable experience servicing, maintaining and overhauling the Academy's aircraft fleet, which consists of 12 D.H. Chipmunks, six Saab Safirs and two DC-3s.

All pilot training is tailored from its commencement for precision airline work. Elementary training to 125 hours is carried out on the Chipmunks, the Saabs being used for a further 25 hours—for navigation and instrument flying. With the co-operation of Garuda Indonesian Airways, Link training accompanies flight training all along. The latest ground flight training equipment for the Academy—in the shape of an AT-100—has recently been installed. No difficulties have been experienced in taking pupils directly from Chipmunks on to the DC-3, and first solos on the latter have averaged 35 hours prior dual instruction. The Advanced Flight Unit, in which a further 120 hours are flown, operates in its latter stages on the basis of a small airline.

In all sections, along with *ab initio* training, the mission's policy has always been to select the best material for instructor training, so that a smooth transfer can be effected when the mission pulls out. This plan has proved most encouraging, and a total of 38 Indonesian instructors—both flying and ground—now work along with the I.C.A.O. experts.

More than fifty per cent of G.I.A.'s aircrew are now Indonesian and 16 Indonesian captains operate the Convair and Dakota services. In other departments of the airline organization, too, more and more Indonesians are taking over and assuming technical responsibility for the operation of their airline and aviation ground services.

With its 3,000 islands strung out over an area equal almost at its widest point to the distance from New York to San Francisco, and with very limited means of surface transport, Indonesia's progress and development as a nation cannot be dissociated from the growth of its aviation. Not only in the airline business but in such spheres as agriculture, police and customs patrol, medical aid, oil prospecting and private flying, Indonesia provides almost limitless scope for aviation. Even the augmentation of G.I.A.'s present fleet of 50 aircraft—Convairs, Herons and DC-3s—with larger and more modern equipment in the shape of Convair 440s and Lockheed Electras only taps infinitesimally Indonesia's immense air traffic potential.

Progress with the new 9,340ft runway at Hong Kong —which has involved the filling-in of Kowloon Bay —indicates that the August 1958 target-date for completion will be achieved. The present runways of Kai Tak are seen in the background.

CERTIFICATING THE 707

ON a wall of this office last April was pasted a typewritten list of dates—roll out, first flight, certification and delivery of America's turbine aircraft. The most significant alteration that has yet been made is a matter of not more than a month, and the earlier dates are beginning to accumulate a series of ticks. It has often been queried whether Boeing, Lockheed and Douglas can hope to meet the tight schedules that they have set themselves, and the answer—as borne out by the writing on the wall—seems to be that they can.

In order to get the C.A.A. certification tests complete by next summer Boeing applied for certification of the 707 in July 1955 and started negotiations the following month. A preliminary Type Certification Board held its first meeting before the end of that year, and the 707 prototype was used to give the C.A.A. representatives their first taste of turbine transport travel. Since that time numerous C.A.A. pilots have flown the prototype.

For jet transports the Civil Aeronautics Board have formulated a Special Civil Air Regulation SR-422, and to meet this regulation (which can be expected to become increasingly familiar) Boeing are preparing to carry out their certification programme with three aircraft from the flight centre at Seattle. The first aircraft, which will be used for demonstrating compliance with the Civil Air Regulations Part 4b, will be equipped with special instrumentation; the second and third aircraft will be fully furnished and used for performance, stability and control analysis and functional and reliability tests respectively. About two thirds of the flight test time with the third aircraft will be spent in accelerated airline proving—a succession of take-offs, climbs, descents and landings. The remaining time will be spent on functioning and reliability checks at cruising altitudes.

The aircraft rolled-out on time, and the first flight, scheduled for this month, is imminent. Certification should have been received and the first delivery made by this time next year.

THE NOISE OF A CARAVELLE

A LETTER to Sud Aviation from "an American airline" contains flattering remarks about the Caravelle's noise level, internal and external. While the Caravelle was in America, this particular operator (whose name Sud Aviation do not wish us to disclose) conducted detailed tests. Here is a summary of their conclusions.

In the cabin, an "acoustical comfort index" of 117 was achieved at the noisiest location, and an A.C.I. of 149 at the quietest location. [A.C.I., it should be explained, is an index believed to have been originated by Douglas, who regard an A.C.I. of 100 as "comfortable."] The anonymous airline goes on to say: "Acoustical comfort indexes of 117 at the noisiest location of the cabin, and of 149 at the quietest location, are marvellous as compared with the respective indexes of 57 and 75 for a certain aircraft renowned for its comfort."

The results of the measurement of the Caravelle's external noise are of special interest in view of the fact that the aeroplane is the only jet airliner which has so far been permitted to land by the Port of New York Authority. This is what the report says: "A number of noise readings were taken on the transatlantic ramp [terminology that indicates that the tests were made at New York] when the aircraft was taxying away for take-off. The measuring equipment was set up approximately 30ft from the left wing-tip of the aircraft, and directly in line with it. The highest noise level recorded as the airplane taxied away from the ramp was 106 db, with about 100 db in the 75 to 150 cps octave band."

A new airport aid is this 300 million candlepower Westinghouse "traffic light" at Washington International Airport. It directs departing aircraft away from built-up areas —practical evidence of America's effort to reduce the noise-nuisance.

EAST AND WEST BY QANTAS

AUSTRALIA'S new link with Europe *via* the Pacific, North America and the Atlantic will be formally established on January 14. On that date two Qantas Super-Gs will leave Sydney, one flying westward by the old Kangaroo route to London, and the other flying east to London *via* San Francisco and New York.

The new service may well become quickly established as Qantas' most lucrative link with London and Europe. Qantas, thanks to the granting of trans-U.S.A. traffic rights by the American Government last summer, will now be able to carry what they have long regarded as their own dollar-route traffic to Europe, instead of transferring it to T.W.A. or B.O.A.C. at San Francisco. This fact, and also the political instability of the Middle Eastern section of the Kangaroo route, constitute the real significance of the new Qantas service, rather than the academic prestige-value of a "round the world" route—a prestige which Qantas will now share with PanAm.

FROM CHICAGO TO DJAKARTA

IT is thirteen years since the nations met at Chicago and fashioned a framework for the operation of international air services. The basis of this new framework was the formulation of five "freedoms," the first two of which covered flying across and landing in countries abroad, the latter three covering the carriage of traffic.

Prewar air transport was frequently the victim of political policy. The Dutch airline was for many years denied the right to overfly or land in Spain, as a result of their government having refused to supply arms to the Republican forces in the Civil war. But since the Chicago conference there has been a growing tendency to take first and second freedoms for granted, except at times of severe national disturbance.

The recent announcement that the Indonesian Government were to deny landing rights to the Dutch after December 3 is a sad but timely reminder of the extent to which air transport is tied to politics. This move by the Indonesian Government coincided with various other expressions of bitterness towards the Dutch, evoked by the United Nations' refusal to support Indonesia's claim to Dutch New Guinea.

The first statements coming from K.L.M. implied confidence in the future. It was declared that an application for future landing rights—the present permit was expiring in any case on December 31 of this year—would be filed as usual. It was also pointed out that technical assistance given by K.L.M. to the Indonesian national carrier Garuda Indonesian Airways was based on a separate agreement, extending until 1960.

The relationship between Dutch and Indonesians appears to be deteriorating. The atmosphere hardly suggests that a new landing permit is likely to be negotiated in the near future. The exodus of about 300 K.L.M. staff seconded to Garuda might well cripple both the internal services operated in Indonesia and the regional services to Singapore, Bangkok and Manila.

If K.L.M. is to continue to serve this traffic area without landing in Indonesia, it becomes imperative to seek traffic rights at Singapore. It is to be hoped that the relationship between Indonesia and the Netherlands will improve in time to prevent other countries —and their airlines—becoming involved in the dispute.

MARSHAL ZHIGAREV AND THE TU-104

THE speed with which Russian leaders wish to negotiate air transport agreements appears to be directly related to that of their leading airliners. For over a year the Tu-104 has been proving itself—apparently to Aeroflot's satisfaction—on the internal routes within the Soviet bloc. Recently a reciprocal arrangement was concluded between Russia and governments of Norway,

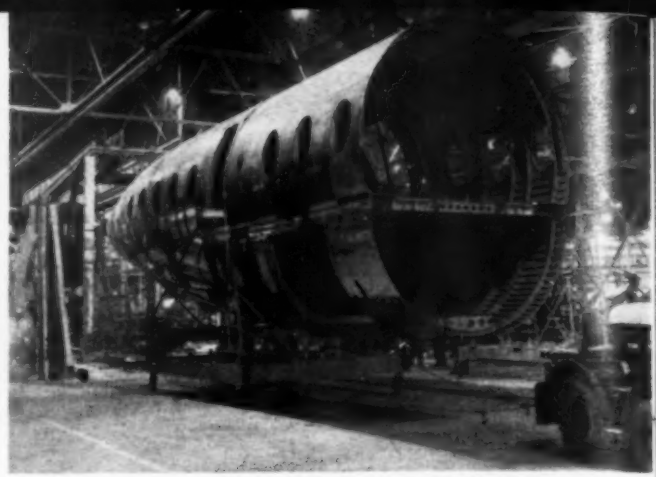
CIVIL AVIATION . . .

Sweden and Denmark whereby a S.A.S. Convair 440 and an Aeroflot Il-14 each operate once a week between Copenhagen and Moscow. Early in the New Year the Tu-104 will be put on to this service.

As forecast in last week's *Flight*, Marshal Pavel Zhigarev, head of Aeroflot, has arrived in London to negotiate a similar agreement between the U.S.S.R. and the United Kingdom.

To the United Kingdom this is not just another European service. There are more difficult issues than establishing an equitable allocation of traffic between Aeroflot and B.E.A. This new service will open up an all-jet route between Western Europe and the Far East which will be 1,000 miles shorter than that operated at present by B.O.A.C. with slower aircraft.

A further complication is that the West knows very little about the precise performance of the Russian aircraft. Permits will depend upon the Russians demonstrating that their aircraft satisfy I.C.A.O. airworthiness requirements. In view of recent Russian scientific achievements, the possibility of this factor being allowed to delay the appearance of the Tu-104 at the airports of Western Europe is surely remote.



The rear section of the first Vanguard fuselage emerges from its jig at Weybridge. Since this picture was taken all three production portions of the fuselage have been conjoined. First flight is scheduled for the latter part of 1958.

BREVITIES

CHRISTMAS should find New Yorkers well aware of the existence of the Britannia as an airliner in regular scheduled service. On December 16 Aeronaves de Mexico plan to initiate their Mexico City-New York service, and on December 19 and 23 respectively the Britannia is due to begin regular non-stop trans-atlantic operations for B.O.A.C. and El Al.

* * *

The first airline to announce its seating plans for the new North Atlantic third-class service is K.L.M. Its seven L-1049Gs are being modified to carry 97 passengers, while the convertible L-1049Hs on order will be fitted for 101 seats.

* * *

On December 3, B.O.A.C.'s two Comet 2Es completed 100 overseas flights (57 to Beirut) and 1,000 Avon 524 hours on engine-proving flights from L.A.P. Since September 16, when the flights started, no unscheduled engine changes have been made.

* * *

The first section of the Port of New York Authority building programme at Idlewild was put into service one minute after midnight on December 6, when the new inward passenger terminal—two storeys high, almost half-a-mile long, and costing over £10 million—was officially in operation.

* * *

Within a few weeks of the announced formation of a new Belgian airline Aviameer (not Dutch as previously reported), an air-advertising company, Martin Schroeder of Amsterdam, has expressed its intention to set up an airline to operate services—at present unspecified—of a kind which cannot profitably be run by large concerns such as K.L.M.

* * *

A proportion of the funds required to finance airline purchases of turbine aircraft will have to come from the sale of present aircraft. Offers of second-hand airliners for sale are now appearing almost daily. The Aircraft Marketing Company of Los Angeles has been developing a network of representatives "throughout the world" to act as brokers. Others can be expected to follow this trend.

* * *

The physical geography and the technical and economical background of international air transport is the subject of a new book, *The Geography of Air Transport*, by K. R. Sealy. Mr. Sealy is lecturer in geography at the London School of Economics and Political Science. The book is published at 10s 6d by Hutchinson.

Mr. Raymond Birkett, M.V.O., D.F.C., is to resign from his post as Civil Air Attaché at the British Embassy in Paris, and on February 1 will join Skyways as general manager—Coach/Air services.

* * *

From January 1958 Swissair's "Supersuisse" services to South America will call at Lisbon and Recife. The call at Dakar is to be discontinued. The route is flown twice weekly by DC-7Cs. Both flights will go from Recife to Rio de Janeiro and Sao Paulo, with one service weekly continuing to Montevideo and Buenos Aires.

* * *

Britain's share in the development of Nandi Airport, Fiji, planned to be ready for Boeing 707s from July 1, 1959, will be about £1.2 million. Total cost, to be shared with Australia and New Zealand, will be about £3 million. The Fiji Government will contribute £300,000 to cover the cost of terminal facilities.

* * *

Confusing statements have appeared about the effect of B.E.A.'s internal-fare increases on the rates charged by Silver City Airways. The position is that the only Silver City fares to be increased are those on services run in parallel with those of B.E.A. The only such service operated by Silver City is that between Belfast and the Isle of Man; no other Silver City fares will be affected.

* * *

There is little uniformity among the latest financial results for the major Australasian airlines. The depressing A.N.A. results were followed by Tasman Empire Airways achieving a record profit of almost £¼ million. The latest to report, Trans-Australia Airlines, show profit unchanged despite a growth in revenue to £9 million.

* * *

Silver City announce cheaper vehicle ferry fares for the summer of 1958 on services to Le Touquet, Calais, Ostend from Ferryfield, and Cherbourg and Deauville from Southampton. The peak fares for busy days prior to May 31 and after October 1 have been discontinued, and peak fares in the mid-summer season have been substantially reduced in number and price.

* * *

Newest proposal to improve the link between London Airport and Central London is an overhead road carried on cantilever piers and closely following the course of the Great West Road. A technical committee is expected shortly to report to the Minister of Transport and Civil Aviation on a monorail link. In the meanwhile, work on the £1 million Chiswick flyover is continuing ahead of schedule.

DOWN WITH AIR FARES (cont. from p. 913)

how necessary was the introduction of tourist fares in 1952, of off-season, family and Servicemen's fares in 1955, and of immigrant and excursion fares in 1956.) It is unlikely that the traffic increases required to ensure an adequate load-factor in the years immediately ahead could be achieved by further extension of rebates to existing fares.

This strong need for an acceleration in traffic growth makes it difficult to understand why so many airlines who were already committed to an expansion in seating capacity were not more enthusiastic about introducing the third-class fare. The new standards of service for third-class passengers must be sufficiently inferior to those on tourist-class services to prevent diversion from such services. If diversion is avoided, it might well be that before long the C.A.B. will be applauded rather than pilloried for its dogged protection of the consumer. J.S.

THE NORTH ATLANTIC TRAFFIC PULSE*

Year	Passenger Traffic (×1,000)			Percentage Change		
	1st class	Tourist	Total	1st class	Tourist	Total
1948	—	—	46	—	—	—
1949	—	—	61	—	—	+33
1950	—	—	73	—	—	+20
1951	—	—	72	—	—	1
1952	—	—	97	—	—	+35
1953	49	75	124	—	—	+28
1954	43	89	132	−14	+19	+ 9
1955	48	109	157	+11	+22	+19
1956	54	131	185	+13	+20	+17
1957	53	148	201	− 1	+13	+ 9

* The figures in this table show total North Atlantic eastbound passenger traffic for the first six months of each year.

BRITANNIA IN SERVICE (continued from page 920)

So far as overhaul life is concerned, the Proteus is doing very well by any standards. Entering service on February 1 at 650 hours, it rose to 850 hours on May 16 and to 1,050 hours on September 18. Thus the Proteus increased its overhaul life from 650 hours to 1,050 hours in 7½ months, a rate believed not to have been achieved ever before. By comparison, published figures show that the Dart rose to 1,050 hours overhaul life after 11 months in service (October 1954).

There have been 74 premature engine removals in 92,500 engine hours; this represents a rate of 0.800 per 1,000 hours. Of these removals, 26 have been due to first stage turbine blade defects since which time a more reliable material has been substituted. Twenty-five removals have been due to ice damage of the entry guide vanes. This damage was caused by mechanical fouling of blocks of ice entering the compressor. Since the gap between the entry guide vanes and the first stage of the compressor has been increased there has been a marked advance in engine reliability, though some of this improvement may be due to a better recognition by the crews of the climatic conditions to be avoided. Engine feathering and failure rates over the last six months have been provided by B.O.A.C. and are shown in Table 2. The Proteus has the second best feathering record of all the aircraft considered while the damage rate is not so far behind the long-developed American piston engines.

TABLE 2—B.O.A.C. ENGINE FAILURES AND FEATHERINGS, MAY-OCTOBER, 1957

Aircraft in fleet	Aircraft type	Engine hours per failure	Engine hours per feathering
19	Argonaut	1,352	2,158
15	Britannia	1,645	3,126
5	Constellation ...	1,871	3,370
10	DC-7C	1,895	1,829
15	Stratocruiser ...	1,824	1,691

On the assumption that the turbine blade failures will be non-repetitive and that the device to prevent ice accumulating in the intake will be proved effective by the current flight tests at Singapore, then the Proteus offers the prospect of developing into an outstandingly good civil engine. It can be seen that the Proteus has an excellent record for its frequency of propeller feathering and its build-up of overhaul life, with a not worse than average initial rate of unscheduled removals. What then are the standards of comparison that justify the prevailing spate of criticism? Presumably the unusual reaction in severe icing conditions outweighs all other qualities, so an explanation of the relevant circumstances may be of interest.

During the initial development phase, engine tests under icing conditions were carried out on an N.A.E. test-bed at Ottawa in the winter of 1954-55 and in flight on an Ambassador aircraft fitted with a water-spray rig. The water concentrations used were those quoted in B.C.A.R. Papers 183 and 254. These requirements state that the "icing condition" can be represented by alternating intercepts, each three miles wide, of intermittent maximum and continuous maximum conditions. The test schedules included runs for 10 minute periods at intermittent maximum water concentrations, thereby demonstrating a reserve of anti-icing capacity to provide a margin against unforeseen trouble. Checks were made both with and without cowl heat in operation and an unconditional clearance was granted.

After nearly 3,000 hours of all-weather flying trouble started. In certain icing conditions, first met on route proving trials, engine malfunctioning appeared as fluctuations of r.p.m., bumps and complete engine flame-outs. The fitting of glow plugs reduced the liability of flame-out to a point where the nuisance value was small enough to allow operations to commence. In no case has a manual relight taken more than 10 seconds.

Over the period February to August 1957 incidents recurred on the stages between Khartoum - Entebbe - Nairobi and Karachi - Calcutta - Singapore - Jakarta. The ratio of the frequency of bumps, auto-relights and flame-outs being approximately 25 : 5 : 1. Where engines occasionally suffered damage, this was mainly to the entry guide vanes; the cause of the trouble is the sudden ingestion of ice falls from accumulations in the intake.

It is interesting that the Far Eastern route has been responsible for the consistent values of 84, 82 and 83 per cent of the total number of events in the three forms of malfunctioning. The present assessment of the conditions to be met before any of these troubles are likely to occur appears to be a graduation through three forms of atmospheric icing: (1) super-cooled water droplets, (2) dry ice crystals and (3) a mixture of ice and water slightly below 0 deg C. The first form offers no difficulty. The second form does not accumulate if warm spots in the intake are shielded. The third form may occur in heavy concentrations in areas of high ambient sea level temperature.

The calculated effect of sea level conditions on the potential water content at the freezing point at altitude appear to be consistent with experience, which has been unfortunate only within latitudes of approximately 20 deg north and south, with the monsoon areas as the greatest threat. The critical sector of the routes shows a seasonal drift. The observation and deduction that malfunctioning has been induced by a combination of factors in cloud, i.e., above 16,000ft and within a narrow temperature band close to zero, is well supported. A new series of engine ground rig tests has shown that in order to reproduce typical malfunctions, as found in operation, the quantity of ice and water in the intake air must be increased several hundred per cent above the original test conditions.

Now to get this "sensation" into perspective. Auto-relights occur once every 250 engine hours and flame-outs once every 1,500 engine hours. On the South African route all six flame-outs fell on three days, May 1, May 6 and May 9, on 1.3 per cent of the total number of aircraft services.

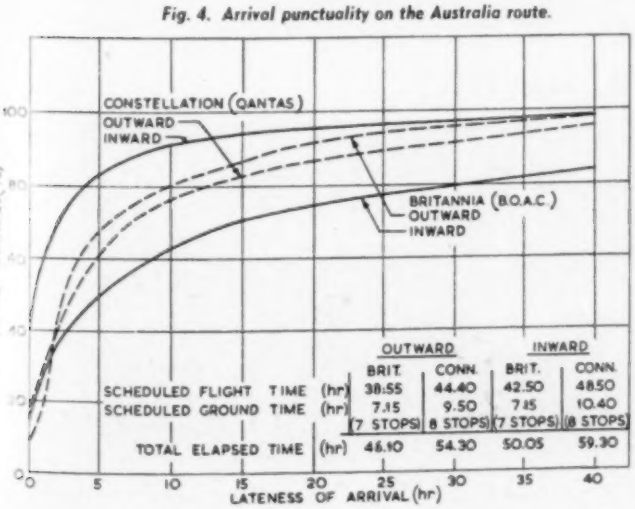
In the first six months of operation the unscheduled engine change rate averaged one per 1,210 engine hours, and 42 per cent of the changes were due to ice damage. Since modification of the entry guide vanes, there has been a tenfold improvement in this particular respect.

The hours lost in the first six months of operation as a percentage of the total flying time reached a formidable proportion of 18.5 per cent, of which four per cent has been due to mistakes by ground crews and unclassified reasons. Of the remaining 14.5 per cent the responsibilities for defects can be split amongst the aircraft manufacturer, the engine manufacturer and the equipment and accessory suppliers in the ratios 1 : 3 : 4 respectively. This is, however, but a superficial picture and as misleading as averages can often be, the result being coloured by relatively few events of large magnitude. Moreover, the dominant events have not acquired their significance so much by mechanical trouble as by the time waiting for spares to arrive. Examples of such cases include a number of fuel booster pumps and brake reducing valves which since modification have shown a different order of serviceability. One should expect the airframe to be reliable and one can expect the equipment to be improved by modification introduced in the light of experience.

The Proteus has acquired its distressing reputation for reasons other than reliability faults in operation. It is true that this engine has misbehaved badly on several occasions though these have most often been in circumstances when it has been driven deliberately into a testing climatic environment. By spitting at its crews it has suffered a like retaliation; such offence is of insignificant physical consequence while the hurt to morale is great. There is no doubt that its service record is quite respectable.

The present judgment is neither final nor absolute, but it can quite reasonably be comparative with the standard set high. In comparing times of arrival at Johannesburg and London for both the Britannia and the long-established DC-7B and times of arrival in Sydney and London (Fig. 4) for both Britannia and the Super Constellation the only sign of inferiority is on the return trip from Sydney; but by this time next year there are good prospects of matching the best achievements of international airline operations. By that time present experimental modifications should be incorporated in the powerplants whilst the accessory situation should be eased by a distribution of spares along the route.

Fig. 4. Arrival punctuality on the Australia route.



		OUTWARD		INWARD	
		BRIT.	CONN.	BRIT.	CONN.
SCHEDULED FLIGHT TIME	(hr)	38.55	44.40	42.50	48.50
SCHEDULED GROUND TIME	(hr)	7.15	9.50	7.15	10.40
		(7 STOPS)	(8 STOPS)	(7 STOPS)	(8 STOPS)
TOTAL ELAPSED TIME	(hr)	46.10	54.30	50.05	59.30

CLUB AND GLIDING NEWS

Warwickshire Aero Club at Elmdon were this year's winners of the P.F.A. Masefield Trophy. Among club awards at the recent dinner ("Flight," November 22) was the Warwick Trophy to W. E. Wassell (left) and the Navigation Trophy to J. Radcliffe

A PUBLICITY panel has been formed by the Royal Aero Club "in an effort to draw attention to the folly of the present official attitude and to win for the private-aviation world in all its aspects some of the recognition that is its due." The club's announcement of this states: "For some time past, the Royal Aero Club has viewed with concern the growing indifference and hostility in certain quarters towards private aviation in this country. Compared with the attitude of foreign governments, notably in France, Germany and Italy, which have resulted in healthy and expanding light-aviation industries, that of the authorities in this country seems aimed only at extinction by neglect and strangulation by an ever-increasing number of regulations and mandatory air traffic control procedures foisted on aviation generally in the name of safety of operation for the big commercial operators. . . ." Members of the panel are John Blake (Royal Aero Club), K. J. A. Brookes (Society of Model Aeronautical Engineers), F. Butters (membership), Maurice Imray (Popular Flying Association), Norman Jones (sporting flying), and W. A. H. Kahn (British Gliding Association).

THE Tiger Club has announced vacancies for ten more pilot members; those interested and with over 100 hours solo should contact C. Nepean Bishop, 49 Zermatt Road, Thornton Heath, Surrey. The date of the club's race meeting at Sandown next season has been changed to Whit Monday, May 26. Participation at air displays at Swansea, Exeter and Goodwood has provisionally been arranged, in addition to the Tiger Club aerobatic contest at Sywell on May 4.

MORE than 2,000 flying hours have been logged since the beginning of April by members of the Vickers-Armstrongs, Ltd. (Weybridge), Flying Club at Fair Oaks. Among recent members qualifying for P.P.L.s was Miss Dinah Anag of the company's aerodynamics department, who is the first lady member to qualify. Sir George Edwards, managing director of the company and president of the club, has also obtained his Private Pilot's Licence—with a Viscount endorsement in Group C.

FOLLOWING our recent report of two flying members of an Australian gliding club aged eleven and twelve respectively, Plymouth Aero Club have weighed in with the news that their youngest flying member is David Fleet, aged 13. Flying instruction in a Tiger Moth and "some very competent aerial photography" in a Gemini have taken up much of his time this season.

BOTH Elliotts of Newbury and Slingsby Sailplanes, Ltd., are building sailplanes intended for use by the British team in both open and limited categories at the world gliding championships in Poland next year. Target date for the completion of these aircraft is February 1, 1958, after which comparative tests will be flown and the British Gliding Association will make the final selection of aircraft for the British team.

From Warsaw it is reported that the rules and marking system for the championships will in general follow the lines of those of the 1956 contest at St. Yan. A suggested innovation, however, is the setting-up of an appeal committee consisting of team captains, the chairman of the sports section of the championship committee and the chairman of the committee of judges.

Leszno airfield, where the championships will be held, is being enlarged at present. New hangars, restaurants and spectators' verandahs are being built. The Polish Aero Club has appointed Marcin Monis, director of the club, to be chief organizer of the contests, and Tadeusz Rejniak, the club's secretary, to be chairman of the sports committee.

TRAINING and touring are the functions of the new PL-9 aircraft designed in Australia by Luigi Pellarini. A single-engined five-seater, the machine is intended specifically to meet the needs of Australian flying schools and private owners. Mr. Pellarini, designer of the Kingsford Smith PL-7 Tanker agricultural aircraft, was commissioned earlier this year by the Royal Aero Club of Queensland to design the new aircraft, and construction of the prototype is expected to begin in January.

IN an information circular (99/1957) dated November 20, 1957, the Ministry of Transport and Civil Aviation announces that the 1957 edition of *Aviation Law for Applicants for the Private Pilot's Licence* is now available. Known officially as C.A.P.85, this publication costs 1s 6d from H.M.S.O. All previous editions are obsolete and, according to the Ministry, should be destroyed.

WITH the double object of assisting Italian aircraft factories and increasing the number of pilots, the Italian government is encouraging the purchase of tourist aircraft by clubs and individuals by means of a 50 per cent subsidy on the purchase price. This applies to any Italian-built tourist aircraft. Some £20,000 was allocated for this purpose for the remainder of the current fiscal year.

FIRST social event to be held in the clubhouse of the Bristol Gliding Club at Nympsfield will be the Christmas Party planned for tomorrow, December 14. Recent activities at Nympsfield have been overshadowed by the tragic death of the club's vice-chairman, John Parry Jones, in the Britannia accident near Filton.

AT the Surrey Flying Club, Croydon, Alan Sproxton has resigned as chief flying instructor on medical grounds. Peter Chinn has now taken over as C.F.I.

A NEW member of the instructional staff at Denham Flying Club is Adrian Vaughan, who learned to fly at the club and made his first solo on his 17th birthday. The opening party at the club's newly decorated lounge bar was scheduled for Friday last, December 6.

MEMBERSHIP of Exeter Aero Club now stands at over 100. Among the club's Christmas festivities is an Ashen Faggot party on Christmas Eve, at which "an ashen faggot will be burnt and the appropriate toasts drunk in mulled ale."

MORE IDEAS FOR CHRISTMAS

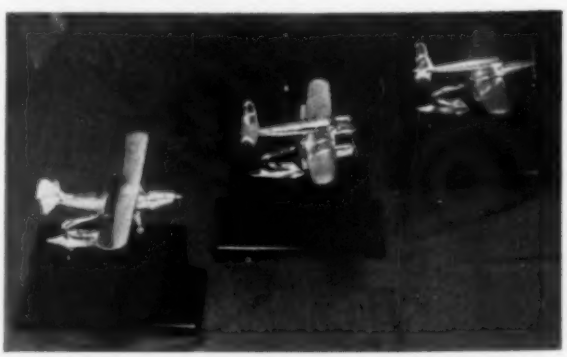
READERS who are still undecided on the purchase of Christmas gifts may be interested to hear of a new line in presentation aircraft models which has been brought out by John Somers, Ltd., 142 Edgware Road, London, W.2.

Illustrated here, from left to right, are an Auster, Gemini and Messenger; the range also includes Tiger Moth and Chipmunk.

Heavily plated, the models have a span of about 6½in and appear to be unusually well made, and the makers' association with Nat Somers, the well-known racing pilot, is a guarantee of accuracy. The stand, which on this type of model too often seems to be added as an afterthought, is refreshingly in keeping with the aircraft. The models retail at 12 guineas each.

Another idea for Christmas is provided by State Express, Ltd., who have produced their usual wide range of novelties. Included this year is a tin of 50 State Express 555 cigarettes in a half-pint or pint glass-bottomed pewter tankard, or in a pottery "Dickens" jug. Cigarettes and cigars are also available in a wide selection of novel packings.

Readers who are still at a loss may like to refer to our issue of November 29, page 832, where a list of books published by *Flight* and its associated journals will be found.



Presentation aircraft models by John Somers, Ltd.

THE INDUSTRY

D.H. Chief Addresses Dowty Apprentices

A LARGE gathering of apprentices and trainees of the Dowty Group, and their parents and friends, were addressed by Mr. A. F. Burke, deputy chairman and managing director of de Havilland Aircraft, Ltd., on November 22. The occasion was the Dowty Group's annual prizegiving at Arle Court, and Mr. Burke was optimistic about the future both of the aircraft industry and of those entering it.

The trouble with the British, he felt, was that we were too modest. We didn't shout enough about our own achievements and were far too eager to give away our hard-earned knowledge. Few people realized the extent of our achievements—for example, the first American jet aircraft had a Dowty fuel system and a de Havilland engine.

Paying tribute to Sir George Dowty, Mr. Burke told the apprentices: "You have in your chairman an example of what can be done with nothing to back you but a sound engineering training, enthusiasm, confidence in oneself, courage, and the health and ability to work hard."

Mr. Burke reassured parents worried by the threat of redundancy in the military aircraft industry. "I can assure you they have chosen wisely. It is the most advanced side of engineering and from it anyone could go into any other branch."

Welcoming Mr. Burke, who later presented the prizes, Sir George Dowty described him as one of the great leaders of the aircraft industry. He reminded the assembly that before many of them were born Mr. Burke flew the Atlantic in the R.100.

Mr. K. J. Hume, Dowty Group education and training officer, thanked Mr. Burke for his address and spoke briefly on the educational activities of the group during the past year.

A New Actuator

A SPECIAL twin-motor offset actuator has been produced by Western Manufacturing (Reading), Ltd. It has been designed for normal working conditions but, in the event of failure of one motor the other, which is identical, carries on normal functioning. Each is controlled by its own main and emergency limit switches and if one switch or other component fails, the other will break the circuit. In operation, the limit switches are capable of adjustment to give a range of strokes. Accessibility is stated to be good and no special tools are required.

The electrical system is in two separate and independent parts. Each is connected to the external supply by its own flying lead, thereby providing an independent supply for each motor. The actuator is flame- and water-proofed. Principal data are as follows:—

Normal working load, 30 lb; maximum working load, 45 lb; normal voltage, 28 volts D.C.; normal current, 1.65 amp; stroke, 2.75in; time of stroke, 4.5 sec/in; time of rating, 1 min; recommended service life, 1,000 hr; weight, 4 lb.

Wakefield and Fletcher Miller

THE entire share capital of Fletcher Miller, Ltd., Alma Mills, Hyde, Cheshire, the parent company of a group of ten, is to be acquired, subject to contract, by C. C. Wakefield and Co., Ltd., the makers of Castrol.

Part of the purchase consideration will be the allotment to the vendors of some of Wakefield's ordinary shares which when issued are to be converted into stock. For the latter purpose an extraordinary general meeting of C. C. Wakefield and Co., Ltd., is being called.

Versatile Crane

A NEW crane for which considerable demand is foreseen from both the industry and the airlines has been developed by the British Hoist and Crane Co., Ltd., of Compton, Berks. Designated the "Iron Fairy" hydraulic mobile crane, it incorporates a number of practical design features.

The crane was originally designed for applications where loads must be moved through a large horizontal distance in relation to vertical lift. Later, a customer asked for a crane capable of handling aero engines weighing up to 35 cwt during installation and removal. Additional requirements were the ability to pass under the wing of a large aircraft, and to travel at considerable speed over relatively rough ground.

In meeting these requirements the company have produced what appears to be a very versatile machine. The crane is powered either by a 2,178 c.c. diesel developing 30 b.h.p. at 1,800 r.p.m. or a 2,200 c.c. petrol engine giving 37 b.h.p. at 1,800 r.p.m. Minimum height is 9ft and width is 7ft 3in. Maximum speeds of 30 m.p.h. unloaded and 5-10 m.p.h. loaded are claimed. Steering is *via* the rear wheels and hydraulic brakes are fitted on all four wheels.

The "Iron Fairy" crane (described here) lifts a Hercules engine.

The jib is luffed by a vertically mounted double-acting hydraulic ram. This is the means of lifting—no hoist winch is fitted, though one is available as an optional extra. The jib can also be extended telescopically by six feet and slewed through a total of 175 deg, both these functions being carried out hydraulically. Maximum lift is approximately 18½ft.

Maximum safe working load is given as two tons; this is reduced to one ton when the jib is fully extended in the horizontal position.

Speed of jib movement is proportional to engine speed and reaches a normal maximum of 70ft/min. To provide the accuracy of control necessary when handling loads such as aircraft engines an additional master hand control is provided to adjust the rate of descent to a minimum of 1in/min.

Optional extras include a glass-fibre cab, audible and visible overload warning, a fork-lift attachment to lift 2½ tons, a shovel with hydraulic opening and closing, hydraulic steering, a hydraulic hoist winch, and a high-speed lift device giving a hoist speed of 100ft/min.

IN BRIEF

Mr. Wilfred Latham has been appointed resident Scandinavian liaison officer of Birfield Industries, Ltd., with an office in Stockholm, and will be responsible for the group's interests in Sweden, Norway, Denmark and Finland.

* * *

Formerly general sales manager of Gerrard Industries, Ltd., and Gerrard Safe Seal (Overseas), Ltd., S/L. Denis Dickson has joined H. and D. Churchill, Ltd., Waterloo Road, South Yardley, Birmingham, as sales manager.

* * *

Mr. P. A. Clayton has been appointed sales manager of Amphenol (Great Britain), Ltd., with effect from December 1. He was previously with Belling and Lee, Ltd. Amphenol are manufacturers of electronic and communications equipment.

* * *

Entitled *Noral Products—Tables of Weights*, a new publication by Northern Aluminium Co., Ltd., Banbury, Oxon, provides a ready source of information on the weights of the company's aluminium products—sheet, corrugated sheet, plate, circles, bar, tubes and wire.

* * *

A visit was recently paid by Mr. J. W. P. Angell, director of F. G. Miles, Ltd., to the Bell Helicopter Corporation at Fort Worth, Texas. Following the return visit of Mr. Owen Q. Niehaus, chief of servo/electronics at Bells, agreement has been reached by the two companies to technical liaison between Miles and Bell, with particular reference to servo/electronic developments and visual-presentation projection systems in helicopter simulators.

* * *

Two new ¼in drills have been added to the range of industrial drills produced by Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, London, W.5. One is a general-duty drill, the OK2c, recommended for all continuous light production and general duty work; the other—described as a *de luxe* heavy-duty production drill, type KG2c—has a patented insulation of phenolic resin moulded to the inside of the switch handle.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

New Deputy Under-Secretaries

APPOINTMENTS of Mr. R. H. Melville and Mr. H. T. Smith (portraits, p. 910) as Deputy Under-Secretaries of State, in succession to Sir Folliott H. Sandford and Sir Victor H. Raby, have been announced by Air Ministry.

Mr. Melville, an Assistant Under-Secretary since 1946, is to be promoted from January 1 next year when Sir Victor Raby retires from public service; and Mr. Smith, who has been Principal Establishment Officer since 1955, will be promoted in the spring of next year when Sir Folliott Sandford leaves Air Ministry to become Registrar of Oxford University.

Three Senior Appointments

NEW posts for three air vice-marshals—A.V-M. W. C. Sheen, A.V-M. A. D. Selway and A.V-M. D. M. T. Macdonald—have been announced by Air Ministry. A.V-M. Sheen is to be Commander of R.A.F. Staff, British Joint Services Mission, Washington, U.S.A., from mid-March 1958; A.V-M. Selway is to be A.O.C. No. 18 (Reconnaissance) Group, Coastal Command, and Senior R.A.F. Officer, Scotland, from May 1958; and A.V-M. D. M. T. Macdonald is to be Director-General of Manning at Air Ministry from February next year.

A.V-M. Sheen has been Director-General of Manning at Air Ministry since March 1955 and was previously Assistant Commandant of the R.A.F. Staff College. All his war service was with Bomber Command. He commanded, in turn, Nos. 106, 49 and 61 Squadrons (in September 1940, flying Hampdens, he was awarded the D.S.O.) and the bomber O.T.U. at Upper Heyford. In 1943 he was appointed S.A.S.O. at No. 92 (Bomber Training) Group and in 1944-45 he commanded the Elsham Wolds, Hemswell and Coningsby bomber stations.

A.V-M. Selway has been Commander, R.A.F. Staff, British Joint Services Mission (U.S.A.) since November 1955 and was previously British Air Attaché in Paris. At the outbreak of war he commanded No. 14 (Bomber) Sqn. in the Middle East, being awarded the D.F.C. in 1940 for leading it on many attacks against targets in Eritrea.

A.V-M. Macdonald has been Director-General of Personal Services at Air Ministry since March this year, having previously taken the 1956 Imperial Defence College course and before that been S.A.S.O. at Transport Command.

Malayan Honours

A SPECIAL list of R.A.F. honours and awards in recognition of distinguished service in Malayan operations, published in the *London Gazette* last week, details the following:—

Honours

O.B.E.: W/C. A. Fry, M.B.E., B.Sc.

M.B.E.: W/O. W. H. Varty; Acting W/O. R. W. Housby.

Awards

D.F.C.: F/Ls. T. Carbis and D. S. Lockhart; F/O. K. R. Steer; M.Plt. A. F. B. Webb; Lt-Cdr. R. E. Wilson, R.N.; Capt. J. E. Nunn, R.R.A.

Bar to A.F.C.: S/L. S. McCreith, A.F.C.

D.F.M.: F/Sgt. F. J. Tattam; Sgts. R. F. Brooks and D. H. Rose, B.E.M., R.A.S.C.

B.E.M. (Mil.): Sgt. A. Sherring; Cpls. N. H. B. England and H. G. Naismith.

Mentions in Despatches: G/C. J. B. Ross, M.B., B.Ch.; S/L.s T. G. Lee, R. G. Price, J. M. Rumsey and D. A. White; F/L.s L. C. E. Cox, R. G. C. Follis, D.F.C., F. H. Hicks (ret.), B. H. C. Martyn, B. P. W. Mercer, A. J. Newbold, R.A.F. Regt., P. Sharpe and J. Walentowicz; F/O.s H. P. Dixon and D. J. Dunstone; W/O.s A. Maurice and C. C. Smith; F/Sgts. D. A. Exley, M. J. Powell, R. H. Robertson, T. Szuwalski, J. F. Taylor and J. A. A'B. Winchester; Sgts. F. A. E. Collings and J. F. Harris; Acting Sgt. G. D. Curtis; Cpls. J. Byrne, R. Gooch, B. Hall, G. J. Hill, J. Orr and G. E. Thompkins; S. A/C.s P. F. Derbyshire, T. Dineen and J. M. Polland.

R.A.F. Awards

AWARDS of the D.F.C. to F/L. D. Harcourt-Smith; of the A.F.C. to F/O. J. H. Carter; and of the Queen's Commendation for Brave Conduct to F/L. S. V. McCoy, M.B.E., were announced in the *London Gazette* last week.

F/L. Harcourt-Smith has been awarded the D.F.C. "in recognition of gallantry and devotion to duty in air operations in Aden"; F/O. Carter, of No. 220 Squadron, brought his Shackleton safely in to an emergency landing under adverse weather conditions after losing both engines on the port side and having subsequently had to fly 315 miles across the Atlantic to a diversion airfield at Lorient/Lennbihoue in France. The citation with F/L. McCoy's award states that "when alone and armed only with a stick he successfully tackled and apprehended five intruders on Cluntoe airfield."

Nottingham U.A.S. Dinner

EVEN in these guided-missile days, the Chief of the Air Staff may still be grounded by fog; but though for this reason Nottingham University Air Squadron were deprived of Air Chief Marshal Sir Dermot Boyle as principal guest at their annual dinner at R.A.F. Newton on December 4, his place was admirably filled by Air Marshal Sir Douglas Macfadyen, the A.O.C-in-C. Home Command.

Sir Douglas, employing an apt Trent Bridge metaphor to admit that in being asked to deputize at short notice for such a notoriously good speaker as the C.A.S. he had been "bowled an extremely fast ball," pointed out that a U.A.S. such as Nottingham had been fortunate in recent axeings in not losing its technical flight; and he confessed that having once been the adjutant of London U.A.S. he always had a very soft spot for university air squadrons.

The Vice-Chancellor of Nottingham University, Mr. B. L. Hallward, urged upon cadets the importance of mastering the spoken and written word as a means of conveying their ideas with precision, topically citing Conrad as a master of his adopted language; and he paid tribute to S/L. N. Fletcher for "most distinguished leadership" of the squadron over the past two-and-a-half years, during which it had twice come second in the Hack competition and been runner-up and this year winner of the Reid Trophy.

S/L. Fletcher, who is shortly handing over command to S/L. W. D. Hooper before going on an Army Staff College course, said this had been "an eminently successful year" for Nottingham U.A.S. There were 46 cadets (four more than last year); with the new intake numbers would rise to almost 70; 2,170 hr had already been flown; and, with a hoped-for 150 hr in December, last year's total of 2,200 hr should be exceeded.

The Secretary of State for Air, Mr. George Ward (right), presenting the C. P. Robertson Memorial Trophy to Mr. Alan Chivers of the B.B.C., at the Air Public Relations Association annual reunion held recently at the R.A.F. Club. Mr. Chivers, a TV producer, won the award for his production of "This is Your Royal Air Force", presented last May.

As a tribute to R.A.F. Newton, S/L. Fletcher presented a squadron plaque to the station commander, W/C. R. J. E. Boulding; and the spirit of the cadets who fly from there was aptly summed up by Acting P/O. J. S. Wingrove who, in replying to the toast by Air Marshal Macfadyen, put past and future Nottingham U.A.S. generations firmly in their place with the unequivocal assertion: "We are a damned fine squadron; it's never been so fine as it is at the moment and it'll never be the same again."

Recent Appointments

AMONG appointments recently announced by Air Ministry are the following:—

G/C. G. R. Bowler to H.Q., Flying Training Command, for administrative staff duties; G/C. D. B. Hatfield to the Ministry of Supply; G/C. J. N. Ogle, to the Air Ministry, for duty in the Department of the Air Member for Personnel; G/C. K. J. McKay to the Ministry of Supply; G/C. S. E. D. Mills to R.A.F. Innsworth, to command.

W/C. C. H. Baker to Air Ministry, for duty in the Department of the Chief of the Air Staff; W/C. B. R. W. Hallows to the Joint Services Staff College, for directing staff duties; W/C. H. Jagger to H.Q., Maintenance Command, for administrative staff duties; W/C. M. Meehan to the Joint Anti-Submarine School, Londonderry, for regiment duties; W/C. J. A. C. Scoular to Air Ministry, for duty in the Department of the Chief of the Air Staff; Acting W/C. J. T. O'Sullivan to R.A.F. Felixstowe, to command.

S/L. J. C. Blair to R.A.F. Coningsby, to command Holding Unit (with the acting rank of wing commander); S/L. L. J. Harding to R.A.F. Kirkham, for administrative duties (with the acting rank of wing commander); S/L. R. D. Walton to R.A.F. Topcliffe, for administrative duties (with the acting rank of wing commander).

A.V-M. Enters Church

A FORMER A.O.C. at A.H.Q. Malta (from 1949 to 1952), A.V-M. N. H. D'Aeth is to be ordained as a deacon at Oxford Cathedral on December 22. A.V-M. D'Aeth, who retired from the R.A.F. in June last year, commanded the Lancaster *Aries* of the Empire Air Navigation School on its record flights to India, Australia and New Zealand in August 1946 and its non-stop flight from Cairo to Capetown in January that year.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Air Sea Rescue Searches

I REFER to Mr. W. Miller's letter on Air/Sea Search in your issue dated November 22. Anyone who has attempted to carry out a *visual* search of the sea surface for an object the size of a man or small dinghy will certainly not be surprised at the ease with which pilots can be lost, much closer even to the shore than was the unfortunate U.S.A.F. pilot.

Radio rescue beacons exist in both the R.A.F. and the U.S.A.F. Sarah is the standard system in the R.A.F., but it is not in use in the U.S.A.F. Even in the R.A.F., though, it is understood that Sarah is only normally worn by pilots when their route takes them over water, and it may be that the pilot of an aircraft that is unintentionally or unexpectedly over water may not be wearing Sarah when he needs it.

In all ordinary circumstances, however, it is reassuring to know that R.A.F. rescue launches and helicopters are equipped to find and rescue anybody in the sea wearing Sarah, and it is common knowledge that this has saved valuable lives on a number of occasions, both quickly and economically in the sense that protracted searches do not have to be made, even in the poorest visibility.

To state what may seem obvious, fixed-wing aircraft unfortunately cannot be used to carry out the actual rescue from the sea, and even a flying-boat finds it almost impossible in the circumstances that prevail on most occasions.

London, W.3. D. KERR,
Assistant Chief Engineer (R), Ultra Electric, Ltd.

Restrictions on the Private Pilot

THE views expressed by "Airline Pilot" (*Flight*, November 29) reveal a most unfortunate partisanship and a lack of understanding of the problems with which the private pilot is beset. Presumably he himself was once "one of us"—and owes his present livelihood to this fact.

We are a very regrettably small fraternity—only some 6,000 all told—and all we ask is that we be allowed to exercise our commonsense and enjoy the freedom of a very small part of the sky. Existing controls credit us with very little grey matter; why not allow us freedom up to say 1,500ft except within those limited areas where commercial traffic must be at or below 1,500ft due to landing or take-off? Between the light-aircraft maximum height and the commercial-aircraft minimum height could be a neutral zone of say 500ft depth. As "Airline Pilot" admits, we all have equal rights in the sky—we none of us pay rent for air—so let controls be introduced only to ensure such equality of air usage.

The installation of radio and other aids in light aircraft is often impractical and always costly. Such increased radio traffic would almost certainly lead to further complaints from such as "Airline Pilot," so that the ether would be so jammed as to make commercial traffic operations impossible. Anyway, when last was a non-radio light aircraft involved in a collision?

Croydon, Surrey. PRIVATE PILOT.

MAY I reply to two of your correspondents whose letters have recently appeared in *Flight*? Mr. Jones asks why prosecutions under the Air Navigation Act 1954 are consistently being launched against private flyers and hefty fines levied in most cases.

It is not surprising that this should be the state of affairs when it is borne in mind that under the Act the hitherto accepted tenets of British law are set aside. For instance, the Act lays down that any deviation, in the interests of safety, from the set pattern of aircraft operations will be considered to be in accordance with the requirements, *provided* the aircraft commander reports in writing within a specified time the full details of such deviations. However, no undertaking is given or implied that the information contained in such a report will protect the said commander from peril of the Court. In effect, the right to reserve his defence is taken from him by the law saying that he must make a statement, incriminating or no! I see no reason why convictions obtained under this section cannot be set aside.

In summation, a pilot is in peril of the Court if he fails to file the required statement concurrently under the Act; the required statement may very likely bring him again into the peril of the Court and without the required warning of "everything you say . . . etc." Our contention is that such action is not admissible by English law and any conviction thereby obtained should be quashed.

With regard to Mr. Tudor's letter (*Flight*, December 6) and his concern over flying alongside one-eyed pilots, there is more in this matter of vision than meets the eye (ugh!) Dr. Baur, in his *Aviation Medicine*, states that one-eyed airmen fly as well as two-eyed airmen, and goes on to state that although not fit for combat duties (for obvious reasons) these pilots should not be grounded through having only one eye. He goes on to say that just how a one-eyed pilot finds the ground is a mystery, but puts forward the theory that by moving the head slightly from side to side the two lines of vision are achieved. The latest theory is that sight lines emanate from the rim of the lenses, each eye getting two lines of sight. Perhaps the real answer is that we really see with our brain?

Whilst on this subject, with great reluctance I inform Mr. Tudor that not all car drivers using the highway have two eyes. To sight a rifle you use only one eye! He will, I hope, not be too chagrined to learn that the one-eyed airman now has a student licence, which brings us to Mr. Tudor's statement that he is too young to die—and on this matter, I feel that even for this Association it would be presumptuous to pass an opinion.

E. Grinstead, Sussex. M. J. CONRY,
Hon. Sec., British Aeroplane Owners and Pilots Association.

AS both an airline pilot and as an enthusiastic private pilot, I think it necessary to point out that the views of "Airline Pilot" (Correspondence, November 29) are not those shared by all members of his profession.

There are, of course, irresponsible private pilots; there are also, unfortunately, irresponsible professional pilots, and the matter of obtaining a Commercial Licence is certainly no golden key to becoming a good, or even sensible, pilot. In general, the standards of the private pilot are very high, and by law he has to show a certain knowledge of air legislation.

Whilst Mr. Jones, in quoting the provisions of the Air Navigation Order 1954, did not, I am sure, suggest that they should cover every irregularity, he suggested that they were designed to cover just such cases as those of Mr. Harris. I am tempted to believe that, had Mr. Harris attempted a landing in a farmer's field, possibly damaging property, himself, and his aircraft, everyone would have been much happier—honour, at least, would have been satisfied. Has "Airline Pilot" never been surprised by adverse weather conditions? If not, I feel he is poorly placed to judge those less fortunate. Perhaps an original error of judgment was made—it can surely happen to any of us—but oh, unhappy day if all the Powers that Be don't do their best to rescue us from our follies. After all, even the *Queen Mary* will stop to assist a capsized dinghy.

Camberley, Surrey. D. W. PHILLIPS.

Launching the Sputniks

WHILST musing in the bath on what seems a certainty—that the Russians have some new form of fuel in order to get the necessary acceleration for the Sputniks—it suddenly flashed across my mind that perhaps there was another means of effecting the initial stages of launching.

For example, I wonder how many of your readers remember the electro-magnetic gun which 30 years ago was reported as far more powerful than Big Bertha and had a range of (I think) 200 miles? This was a German invention, and many Germans are unwilling guests of the U.S.S.R. Could some mathematician say whether this is feasible or not, assuming the gross weight of the space vehicle is, say, 100 tons?

London, W.1. B. J. HURREN.

Training Commercial Pilots

WE were very interested to read details of the scheme put forward by General Air Training, Ltd., for subsidising the training of pilots for the airlines, for this must provide at least one source of recruits for a sadly starved profession. However, we would like to put on record that such an idea is far from new and it is certainly not the only one available to interested parties.

At the present time we have two pilots, well on the way to obtaining their Commercial Licences, who have been sponsored by an independent airline company after signing a contract to repay the loan made in the form of a lower salary for their first three years of employment. In each case, as with the G.A.T. scheme, the individual was required first to train to Private Pilots' Licence at his own expense.

Although these examples were initiated by a particular airline company, we have circularized an offer to all independent operators for a scheme run on very similar lines, and already considerable interest has been shown.

Broadly, the idea is this. As a flying training school we receive as students many young men who have the ability to become commercial pilots but who are unable to afford the full cost of training to professional licence standard. These men, after an initial

CORRESPONDENCE . . .

interview and selection by ourselves, are then offered to any airline or charter company interested and if they satisfy that organization's requirements, are asked to sign a contract for a minimum of, say, three years' service. A loan is then arranged between the operator and the student, who on qualifying and until full repayment is made receives a lower salary than would normally be the case. The contract, therefore, is between the two parties directly concerned, but we undertake the initial selection from our own students and complete the training.

In this manner, only those men enthusiastic enough to *start* flying at their own expense and initiative are considered, and as we are able to train an average student from scratch to Commercial Licence standard for *under £1,000*, we feel that we are providing perhaps the most practicable, simplest and least expensive medium for helping to fill the gaps that are bound to appear in the right-hand seats in the next few years.

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The Sopwith Tabloid

IT was pleasant to read another of Mr. Bruce's contributions to aeronautical history in his articles on the Sopwith Tabloid. There is one point I should like to raise in this connection which I have not seen previously mentioned: the fact that Harry Hawker, and not Fred Sigrist, was chiefly responsible for its design.

Though most historians state that Sigrist was responsible for the design, no contemporary reference to the Tabloid supports this view. All state with more or less emphasis that it was primarily Hawker's creation. In *Flight* for December 20, 1913, it is stated that Hawker had played an important part in its design; in *Aeronautics* for December, 1913, it is written that the Tabloid was "designed by H. G. Hawker"; in *The Aeroplane*'s report on the 1914 Schneider Trophy it is stated that Hawker had much say in the original layout of the Tabloid, while Sigrist's contribution to the victory is described as his skill in handling men and designing details. Finally, Mrs. Hawker, in the biography she wrote of her husband, suggests that his chief claim to fame lay in having designed the Tabloid.

There can be little doubt that Hawker should be remembered as the Tabloid's designer as well as for his piloting skill, and it would be interesting to know if he was also responsible for the immortal Sopwith fighter of the 1914-1918 War, the descendant of the Tabloid.

Mr. Bruce tells me that he would hesitate to accept without reservation that Hawker designed the Tabloid throughout single-handed; and it is quite probable that Sigrist may have played some part, especially in designing the aeroplane's structure. But it should be remembered that Sigrist was no more a trained engineer than Hawker: both were self-taught mechanics, and Mrs. Hawker states that one of her husband's hobbies in his youth was the design and construction of engines. Thus Hawker might have had more experience of design than Sigrist.

Walton-on-Thames, Surrey. DAVID SAWERS.

Jet Aircraft in 1939

IN the obituary notice of Count Gianni Caproni in your issue of October 8, it was stated that the Caproni-Campini C.C.1 was the first jet-powered aircraft to fly. I think it correct to say that this machine was in fact preceded by the Heinkel He 178 which, powered by a Heinkel-Hirth centrifugal turbojet, first flew in August 1939; and by the rocket-propelled Heinkel He 176 which flew in June 1939.

London, W.1. R. T. SMITH.

[Our correspondent is quite correct.—Ed.]

The View Ahead

MAY I say how refreshing it was to read in "The View Ahead," by Mr. L. F. E. Coombs (*Flight*, November 8) the suggestion that the field of vision in large modern aircraft should be improved. All too often one hears that *because* the field of view is poor and *because* the captain and the first officer are both extremely busy, the responsibility for keeping an anti-collision watch should be transferred from the pilot to Air Traffic Control (by restricting and sterilizing even greater volumes of airspace).

May I ask, however, why Mr. Coombs did not take his thesis one step further and praise the canopies of the Canberra Mks 8 and 9, the Northrop all-wing bomber and the side-by-side (snake-eyes) bubble canopies which have appeared on some American military transports? There are many obvious disadvantages in placing captain and co-pilot in separate bubble canopies, but could we not see a recent evaluation of these disadvantages weighed against the inadequacies of the present-day transport cockpit?

With reference to Mr. Coombs's proposal to reflect a gunsight-type dot from the windscreen to show "the aiming point of the aircraft trajectory," it would be extremely interesting to hear from what data this trajectory dot could be obtained. It is difficult to see how any form of Doppler radar could be made to think in terms of Mr. E. S. Calvert's dynamic perspective diagrams of aircraft approaches.

Surely a fixed reflector-sight dot would still be of great value in giving the eyes a frame of reference wherewith to detect drift and hence lead the eye more rapidly to the aiming point of the aircraft trajectory? In my own proposal for instrument presentation by reflection (*Journal of the Institute of Navigation*, April 1951) it was proposed to reflect many instruments from the windscreen itself, but in a revised scheme (*Flight*, January 8, 1954) only such a fixed aiming dot and Zero Reader needles were reflected from the windscreen, leaving the artificial horizon and all other essential instruments to be reflected from a black and glare-proof continuation of the windscreen into the cockpit so as to reduce the obstruction of the windscreen to a minimum while retaining the vital ability to read instruments with eyes focussed at infinity.

Lastly, I would be most interested to hear from all others who have superimposed a rectangular frame of reference round their artificial horizon. To the best of my knowledge, this has never been tried during the evaluations of different horizon presentations, either in this country or in the U.S.A. Does the rectangular frame help in this instance?

Stockport, Cheshire. O. W. NEUMARK.

Classics of Aviation Literature

IN recent weeks I have been delighted to see several letters from my old friend Maurice Austin in these columns covering a variety of topics. Leading on from his story of a flight through the Arc de Triomphe I recall that a flight through a hangar formed an amusing incident in a recent American film *Wings of Eagles*. It had no indication of being faked; as a matter of interest does any reader have further information on this score?

To change the subject, however, what is so evident from recent correspondence is the long-standing interest and enjoyment many of us derive from books now long out of print. For my own part, for example, although the first world war was long before my time I find the combat stories of Ball, McCudden and Mannock every bit as thrilling as those of Gibson, Johnson and Gibbs.

But what rarities those 40-year-old books are becoming—although no one enjoys the quest in second-hand bookshops more than I! But, nevertheless, the First World War classics are already scarce and the prices asked by many a London specialist bookseller are reaching the realms of fantasy.

What seems to be needed is the resuscitation of the Aviation Book Club, an inter-war organization which was responsible for Dallas Brett's *History of British Aviation*, for example. Surely there is a place for a book club designed not only to produce more reasonably priced copies of current publications but also reprints of the earlier classics?

I would be interested to learn something of the fate of the Aviation Book Club and the feasibility of a similar club today.

Windsor, Berks. C. JOHN BARRON.

IN BRIEF

Mr. C. G. Hollowell, publicity manager of D. Napier and Son, Ltd. (Acton, London, W.3), writes to say that in connection with next year's celebrations of the 150th anniversary of the founding of the business he would be grateful for news of any Napier-engined aircraft (e.g., Tempest) in this country and capable of being flown.

FORTHCOMING EVENTS

Dec. 14. Bristol Gliding Club: Christmas Party.
Dec. 14. Plymouth Aero Club: Christmas Party.
Dec. 16-19. Imperial College: Four-day Course of Lectures on "Use of Ceramics and Cermets in Aeronautical and Nuclear Engineering."
Dec. 17. R.Ae.S.: Section Lecture: "Comparison of Ducted Fan, By-pass and Straight Jet Engines," by Dr. S. G. Hooker, F.R.Ae.S.
Dec. 18. Kronfeld Club: Christmas Party.
Dec. 18. Royal Society of Arts: "Sir George Cayley: A Pioneer of Science and Engineering," by Capt. J. Laurence Pritchard, C.B.E., Hon.F.R.Ae.S.
Dec. 21. Lasham Gliding Centre: Christmas Party.
Dec. 21. Elstree Flying Club: Christmas Party.
Jan. 2. R.Ae.S.: Young People's Lecture, by A. W. Bedford, A.F.C., A.R.Ae.S.
Jan. 4. British Interplanetary Society: "High Altitude Research During the International Geophysical Year," by Dr. R. F. L. Boyd.
Jan. 10. Helicopter Association: "Boost Systems for Helicopter Gas Turbines," by A. W. Morley, Ph.D., A.F.R.Ae.S.
Jan. 15. R.Ae.S.: Main Lecture at Leicester: "Rolls-Royce Engines," by A. A. Lombard, F.R.Ae.S.

R.Ae.S. Lectures (to Jan. 15):—
Dec. 16, *Henlow*, "Artificial Satellites," by Dr. M. W. Ovenden. Dec. 17, *Boscombe Down*, "The Weapon System Concept," by H. Davies. Dec. 20, *Weybridge*, Annual Dance. Jan. 7, *London Airport*, "Airline Operational Flying," by Capt. W. Baillie. Jan. 8, *Bristol*, "Fail Safe Structures," by N. F. Harpur; *Southampton*, Annual General Meeting and Film Show; *Weybridge*, Brains Trust. Jan. 14, *Boscombe Down*, "Aircraft Control," by Prof. G. A. Whitfield; *Cambridge*, Lecture by W/C. Lewis. Jan. 15, *Leicester*, Main Lecture (see above).

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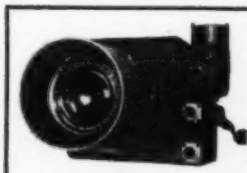

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 1137/1 from Eagle Airways, Ltd., of 40 Edgware Road, London, W.2, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate with Viking and Viscount aircraft until 30th April, 1965, between London Airport and/or London (Blackbushe) and Stuttgart so as to permit them to include an optional traffic stop at Luxembourg.

APPLICATION No. 1561 from Derby Aviation, Ltd., of Derby Airport, Burnaston, Derby, for a seasonal U.K. Internal Service with Dakota and Marathon aircraft for the carriage of passengers, supplementary freight and mail between Glasgow (Renfrew) and Jersey with an optional intermediate traffic stop at Derby at a frequency of five return flights weekly during the season April to September inclusive each year for seven years from 1st April, 1958.

APPLICATION No. 1562 from Captain F. S. Lister, M.A., of 40 Nursery Road, Bishops Stortford, Herts, for a U.K. Internal Service with Auster Mark V aircraft for the carriage of passengers, supplementary freight and mail on the route Stansted-Stapleford Tawney-Southend (optional) at a frequency of up to four return flights per week increasing according to traffic demand to 12 return flights per week for two years from January, 1958.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [7377

PUBLIC APPOINTMENTS

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DEPARTMENT OF SUPPLY

AUSTRALIAN DEFENCE SCIENTIFIC SERVICE

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QUALIFICATIONS: Scientific Officer, Grade 1: Appropriate Honours degree. Some relevant research experience would be an advantage.
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QUOTING Ref. AP.89. [7383

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QUALIFICATIONS: (a) Experience as an aircrew member, preferably pilot. (b) Knowledge of air traffic control, radio aids to navigation, general aeronautical communications and aviation law. (c) Experience on the operational staff of a Government or a civil aviation agency or airline and in the general aspects of airport management, with a wide operational background.

KNOWLEDGE of customs and immigration requirements, and of East African conditions and Kiswahili, desirable but not essential.

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PATENTS

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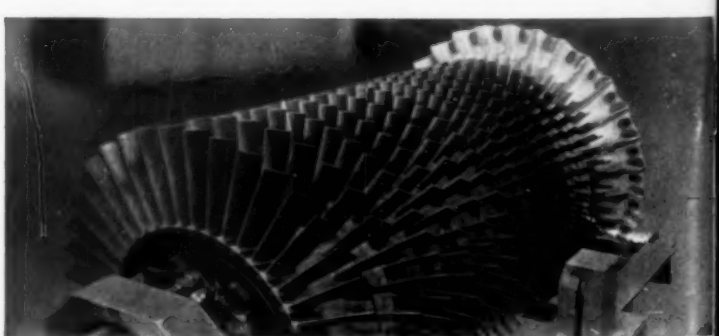

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